# PRACTICAL SEAMANSHIP

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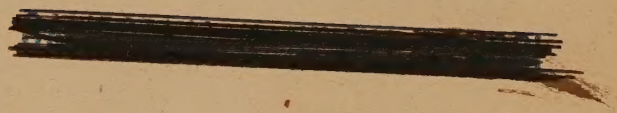

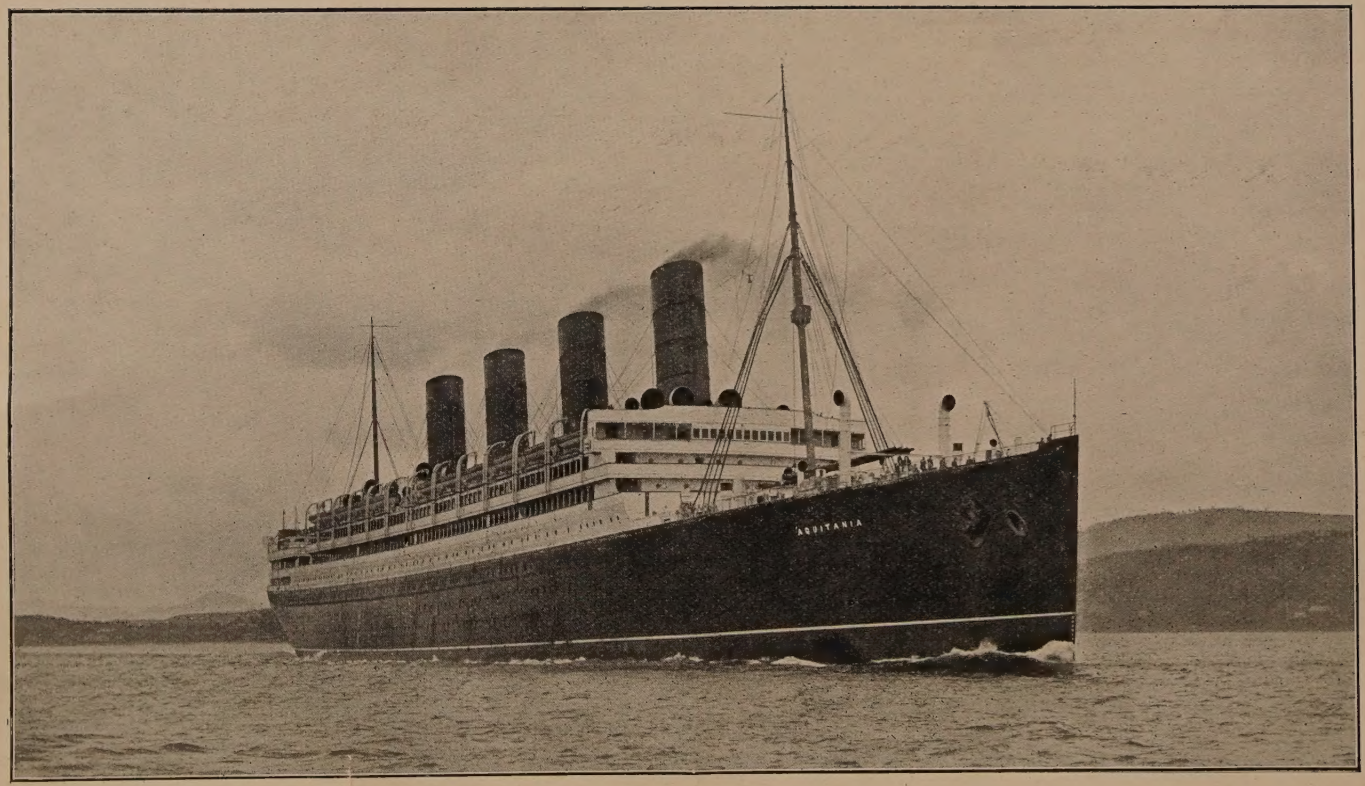


*SS. AQUITANIA.*

# PRACTICAL

# SEAMANSHIP

FOR USE IN THE

# MERCHANT SERVICE:

INCLUDING ALL ORDINARY SUBJECTS;
ALSO STEAM SEAMANSHIP, WRECK LIFTING, AVOIDING COLLISIONS, WIRE SPLICING, DISPLACEMENT, AND EVERYTHING NECESSARY TO BE KNOWN BY SEAMEN OF THE PRESENT DAY.

By JOHN TODD,
*Master Mariner, Commander in Lord Durham's Service, formerly of the Indian Marine and Turkish Navy.*

AND

W. B. WHALL, F.R.A.S.,
*Principal Officer, Board of Trade;*
*Extra Master, Younger Brother Trinity House, formerly Commander in Messrs. Donald Currie & Co.'s Service;*
*Author of "Handy Book of the Tides," "Handy Book of the Stars," &c.*

SEVENTH EDITION
(REVISED AND ENLARGED)
By C. S. MENCE, F.R.A.S.,
*Extra Master; Temp. Act.-Com., D.S.C., R.N.R.*

WITH 176 ILLUSTRATIONS AND DIAGRAMS.

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D.R. Beaumont

DEDICATED

TO

THE YOUNGER MEMBERS

OF THE

MERCHANT SERVICE.

## PREFACE TO THE SEVENTH EDITION.

In the Preface to the Fifth Edition Capt. W. B. Whall referred with kindly sympathy to the death of his co-author Capt. John Todd. With the advent of the Seventh Edition it has fallen to the lot of a son-in-law of the latter to chronicle the death of the other original author of this work.

Many letters passed between me and those two good seamen in connection with the progress of this "Seamanship," so I am not entirely ignorant of their ideas and wishes concerning its future.

Although mechanical power has almost entirely taken the place of wind and sail in ship propulsion for oversea voyages, and steel and iron for that of wood in construction, the good seaman of twenty-five or more years ago would be considered a good seaman and a useful man on board of any of the most recently built ships. It is not therefore so much a case of alteration in the modern methods of seamanship as it is of addition, and that has entailed the enlargement of this book in general.

The modern practice of ship construction of steel and iron has been included, but only to an extent that might be considered as a knowledge of seamanship.

I hoped to have included many more pages on signalling, but that department at the Admiralty have advised me that new and considerable alterations are being made to meet a new situation caused by the war, and that not until peace has been signed will the "Allied Signal Manual" be allowed outside of Allied naval influence. I am therefore compelled to hold over a summary of it until such time as permission to include it can be obtained.

1919. C. S. MENCE.

# PREFACE TO THE FIFTH EDITION.

The continued appreciation of seamen makes a new edition of this book necessary; this is very gratifying to me, the surviving co-author.

I cannot let this opportunity pass of referring to the death of my partner in this work, to whom much of the value of the book is due. He was a thorough seaman, even to his last words. As his ship was foundering (she was cut down off the *Royal Sovereign*) he was heard to hail the colliding vessel, "Keep her going ahead, captain!" The master of that ship, however, lost his presence of mind, and rang "full speed astern," backing out of the rent he had made. Poor Todd went down with the chief part of his crew, amongst them his mate and steward, both of whom had been with him for some twenty years. John Todd was ever active in behalf of his fellow seamen, and was for years known as a writer on Nautical matters under the names of "Collier Skipper" and "Rhadamanthus."

On the morning of March 30th, 1899, I received his sailing letter from Sunderland; in the afternoon paper I saw the report of his loss. Such is life!

Active to the last in the service of his fellow-man, he wrote in that letter: "I am getting up a strong petition to the Trinity Brethren for a fog siren on High Whitby." A few years previously a similar petition, got up and forwarded by him, resulted in an Occulting gas buoy being placed on the Whittaker Spit. But for him this book would never have been written.

A few minor alterations have been made in this edition, and plates of a Jury Rudder, which answered its purpose, and a proposed arrangement for stowing boats have been added.

W. B. WHALL.

*January, 1903.*

## PREFACE TO THE THIRD EDITION.

The fact that a Third Edition of this book is called for shows that our work is appreciated by our fellow-seamen. This is gratifying to us. The present edition has been revised and brought up to date. It contains the New Rules of the Road and the New Fog Signals: these matters are now probably settled.

The chapter on Stowage has been enlarged; and at the suggestion of several, whose opinions we value, the Vocabulary of Nautical Terms has been made much fuller, and an Index has been made. Save for these and a few other additions the book remains as it was. We can only hope that it will still meet with approval.

## PREFACE TO THE FOURTH EDITION.

In presenting this book to the notice of our brother Seamen, we think no apology is needed, being, as far as we know, the first book exclusively on Merchant Seamanship ever published, the old, out of date works of D'Arcy Lever and Brady being as much Naval as Mercantile. It does not attempt in any way to supplant the numerous Seamanship "Guides" to the Board of Trade Examinations. It has been endeavoured, as far as possible, to bring it up to date in matters of general information, and will, it is hoped, assist the rising members of the Merchant Service in studying their arduous duties, and perfecting themselves in their profession.

After the arduous and long continued labour of getting up the work, we no longer wonder that such a book has not been attempted before. As to the illustrations, these we were forced to design, as best we could, ourselves, and must ask forbearance for their lack of artistic merit. The detail, which is the chief thing, will be found correct, and the Publishers have given us great help in this matter by re-drawing them. We here tender our thanks to the many Shipmasters who have assisted us in various ways by hints, criticisms, and information; and shall feel further indebted for any suggestions, sent through the Publishers, for the improvement of subsequent editions.

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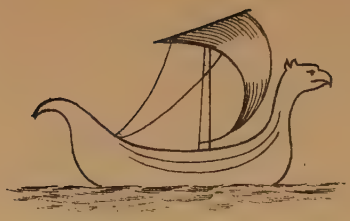
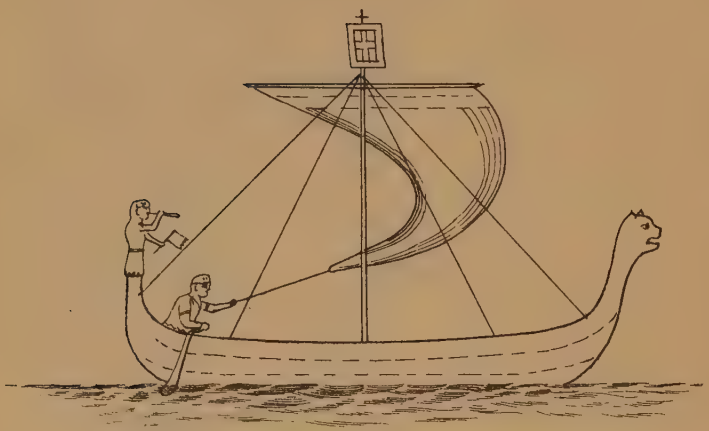


ANGLO-SAXON VESSEL. From an old MS.



THE SHIP OF WILLIAM THE CONQUEROR. A.D. 1066. Bayeux Tapestry.

A SHIP OF THE YEAR 1380, A.D. Probably about 200 tons. After Froissart.

## A SHORT HISTORY OF THE PROGRESS OF BRITISH SHIPPING.

The early history of British shipping is veiled in considerable obscurity. Before the year A.D. 973 there is scarcely any historical notice of vessels belonging to this country; but at that date, under Edgar, we hear of a fleet being in existence, though it was probably composed of small vessels, the largest of which would possibly be 50 or 60 tons. These would all be single-masted craft, with one sail only, set from a yard.

In the year 1008 we learn that Ethelred levied a tax to build ships, and from this date onwards the references to British shipping grow more numerous. In 1066, Harold gathered a large fleet together at Sandwich to repel the landing of William, which, however, was allowed to disperse before the Conqueror made a move. A likeness of William's ship, which is, however, probably, considerably inaccurate, has been preserved in the Bayeux tapestry. The master of this vessel had the title of Stierman, which still survives in German.

There does not seem to have been any great stride in ship-building from the time of the Conquest until the reign of Richard *Cœur de Lion*, about the year 1189. Larger and better vessels were built now, and trade was established with more distant countries. The Crusades also gave considerable impetus to ship-building, as many vessels were required for the transport of troops and horses. Richard established a code of marine laws, which form the basis of our present maritime legislation. They were termed the laws of Oleron, from the name of the island where they were drawn up. The vessels of this reign were termed "galleys" and "busses;" they had a single mast and yard, and one square sail; they were steered by paddles, one on each quarter, the standing rudder not yet being introduced; they were also partly propelled by oars. St. George's Cross as an ensign was probably introduced in this reign.

Up to this time there does not appear to have been any Royal Navy. John seems to have been the first king who founded a fleet exclusively for war purposes, and even then, and hundreds of years afterwards, the ships that fought in war time were used for trading purposes in time of peace, and there was as yet no naval service of men and officers. The term "master" now first appears as the title of a commander of a vessel, who was also called a "rector." Ships now reached a size of 80 to 100 tons, that being the number of tuns of wine they would carry; this is the derivation of our present word ton.

In the reign of Henry III. appears the first notice of lights being carried at night. There is a specification of the building of a French vessel of this period, which gives some idea of the dimensions of ships at that date.

She was to be 108 feet over all.

70 feet length of keel.

She was to have a first deck.

A second deck 6½ feet high.
Above this, a corridor 5 feet high, and
A palisade 3½ feet high.

Her extreme depth was to be 39½ feet. There was a short fighting deck at each end called the '*bellatorium*.' The details of her rig have not been preserved, but she would probably have two masts, the foremast raking over the bow, and would carry two square sails. She would measure at least 300 tons.

Early in the 13th century appear the first notices of the use of the compass. It consisted of a magnetised needle placed in a rush, or a piece of cork, floating in a vessel of water. It was accredited with the property of pointing to the Pole star, which before that time had been used for directing a vessel's course at night. The Italians were the first who, at a later date, used the compass card divided into 32 divisions.

About the year 1300 appears the first record of a rudder, vessels having been previously steered by paddles on the quarters. In times of war, merchant vessels were still impressed and used for battle, and admirals were appointed to command the fleet—as warriors, not seamen. There was, in fact, still no exclusive sea service for war. The average size of the largest vessels was now about 200 tons, and the common terms in use to describe them were 'cogge' and 'carack.' They seldom had more than one mast and sail.

Under the energetic and warlike Edward III. shipping increased. In this reign, in the year 1340, the first *great* naval battle in our history was fought against the French at Sluys, resulting in a complete victory for the English ; this fight is also remarkable as furnishing the first record of a nautical manœuvre ; the English fleet, standing off to gain the weather gage, enticed the French fleet out of harbour in chase of what they fancied a flying enemy. Many sea terms now appear which are still in use, such as yards, stays, backstays, crane-lines, hawsers, seasings, sheets, bowlines, leach ropes, reef ropes, helm, tiller. Drawings of vessels in the works of the great chronicler, Froissart, give us a good idea of the ships of this period, and here we first see vessels with three masts.

Under Henry V., about 1417-1419, records appear of larger vessels. His ship, the "Mary of the Tower," was 500 tons. Caracks now had two masts. There is a record of a ship of 108 feet length with a keel of 110 feet (?). We may assume that the build of ships gradually improved, though until the reign of Henry VIII. the accounts of them are but meagre. This king, however, built larger and more powerful vessels than any previous ones, and the accompanying drawing (after Holbein) will shew the style of them ; it is probable that several of his vessels were as large as 1,000 tons. At this time the necessary offices seem to have been planned for a naval system. A Navy office was established with a sort of Board of Admiralty for its management ; the Trinity Houses of Deptford, Hull, and Newcastle, were also founded for managing pilotage, buoyage, and lighthouses ; and the Navy yards of Woolwich and Deptford were established ; but England was not yet an important maritime power—the great merchant seamen of the middle ages being the Venetians and North Germans of the Hanse Towns ; the great explorers and annexers being the Portuguese and Spaniards.

By the returns of the Navy Office to Parliament in 1791, the decline and progress of the Royal Navy under the Tudors is well shown.

At the end of Henry VIII.'s reign its tonnage was 12,500.
At the end of Edward VI.'s „ „ 11,065.
At the end of Mary's „ „ 7,110.
But at the end of Elizabeth's „ „ 17,110.

At the time of the Armada the latter sovereign had at sea one hundred and fifty sail, of which, however, only forty were the property of the crown, the rest belonged to merchants who were liable to be called upon to furnish their largest craft for the public service. Besides the vessels thus called out for war, the Merchant Navy is said to have amounted to another one hundred and fifty sail, of an *average* capacity of one hundred and fifty tons. Until about one hundred years ago it was difficult to distinguish the Merchant from the Royal Navy. The great seamen of Elizabeth's days may be claimed for the Merchant Service.

Vessels now approached to a type which is familiar to all, the rig gradually becoming more and more like that of the present day, one chief difference being that there were not yet, or for many years after this date, any fore and aft sails, with the consequence that great value was placed on the bowline to set the huge square sail as flat as possible when lying near the wind, as is still the fashion in the North country coble of the East coast, and in the courses of square-rigged vessels. An early trace of the nautical chantez or shanty is found in connection with this in an old work, where the seamen are said to sing as they haul, "hou boulena," which probably still survives in the song of the present day.

"Haul the bowline,
Kitty is my darlin',
Haul the bowline, the bowline haul!"

During the reigns of James and Charles I. the reputation of the English shipping was not maintained, the Dutch beginning to be a superior naval power to ourselves. These matters wonderfully changed under the Commonwealth, when under the great Blake, the Navy became once more the first in the world. The vessels now were in construction little different to what they were up to the time of Nelson. The full-rigged ship had all the principal sails of a ship of the present day, only that even yet no fore and aft sails existed except the mizzen. The bowsprit carried a sprit-sail, and on the bowsprit end was raised a mast, the sprit topmast, which carried another square-sail. The accompanying sketch from a medal struck in the reign of Charles II. gives a good idea of a first-class ship of that date. In some parts, especially in the Mediterranean, and also at Sallee and Rabat on the Atlantic coast of Morocco (the home of the dreaded Sallee rovers), much of the navigation was carried on still by galleys, vessels which in a large measure depended on sweeps for propulsion.

Notwithstanding the wars and disturbances of this period, commerce and shipping continued to increase. At the time of the Revolution of 1688, the tonnage of the Merchant Service was 144,264; but, besides this, foreign tonnage to the amount of 100,524 was also employed, shewing a very respectable total; and from this time the increase was rapid, and the improvement in ships more marked, which to a great extent must be credited to those powerful corporations the East India Companies.

During the next hundred years there was not a great change in the rig and general shape of vessels, though of course considerable improvements took place. The mizzen gave way to the spanker, and the jib was introduced, and later the flying jib. The sprit topmast and sail disappeared, and though the sprit-sail lingered

on, it also got gradually into disuse. The rig then became much as it still remains, except that in the Merchant Service a mizzen course was introduced, and given the name of the cross-jack. In the hulls the high towering poops and forecastles became lower, and fighting vessels, with most traders also, were built without sheer, the straight decks being found more suitable for fighting guns, which were carried by men-of-war and merchant ships alike.

Between the years 1790 and 1800 steam was applied to the propulsion of vessels, but seventy years more were to pass before it was destined to entirely revolutionize the Merchant Service. It is true that most of the large mail steam services came into existence before this, but until the Suez Canal became a great fact, steam vessels did not come into *general* use as traders, and nearly drive the sailing vessel from every sea. In the meantime the Californian gold fever, and later the Australian gold rush and the tea trade, brought the short eras of the clippers. The first and most celebrated clipper era was from about 1840 to 1855. Great speeds were obtained in many instances, and wonderful individual runs were made.

For instance :—

The "Houqua," Shanghai to New York, 88 days.

"Swordfish," Shanghai to San Francisco, 31 days (making the astonishing *daily average* of 240 miles throughout the passage).

"Comet," San Francisco to New York in 76 days.

The "Northern Light," on a voyage from San Francisco to Boston, made the wonderful average of 200 miles a day.

"Dreadnought," Sandy Hook to Queenstown, 9¾ days.

In actual day's runs, the "Flying Cloud" reports a properly verified run of 433 nautical miles in 24 hours, and the "Sovereign of the Seas" 419 in the same time, being nearly up to the daily average of our *best* Atlantic liners of to-day.

Later, the Black Ball clippers to Australia did wonderful work ; *e.g.*, "James Baines," Boston to Liverpool, 12 days 17 hours ; and for a short time the English tea clippers in the races home astonished the nautical world with their sailing.

It is true that the vessels here mentioned were American-built, and, except the "James Baines," American-owned. Of British vessels of that period it will suffice to mention Messrs. Green's "Challenger," which vessel raced home, against the American "Challenge," from Anjer, making a 62 days' passage, and winning by two days. The "Lightning," American-built, which made a passage from Melbourne in 63 days. In later times we come to the tea clippers—such as "Serica," "Taeping," and "Ariel" ; and the Aberdeen clippers of Messrs. Geo. Thompson & Co., of which the "Thermopylæ," although now relegated to the coal trade, still carries the cock at the masthead. This ship has made a passage home from Melbourne in 60 days.

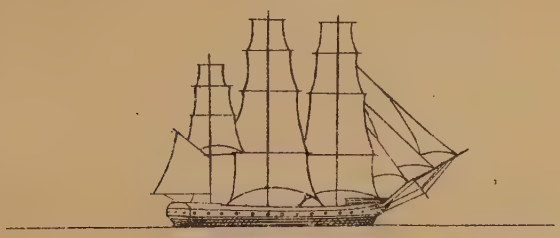
Many of the old East India Blackwallers made wonderful passages, considering their shape ; for instance, Green's "Alnwick Castle," from the Channel to Sandheads twice in 68 days. But in the case of these vessels much was due to the knowledge of the winds on the route which their masters possessed, and also to the way in which sail was carried on ; being heavily manned, they hung on longer and made sail sooner than ordinary vessels, and being very fine sea boats, were seldom if ever hove to. The writer has seen topmast and square lower studding sails carried in one of these vessels when the first reefs and fore and mizzen topgallant sails were in.

From the year 1870 the annual tonnage of steam-ships has increased by very rapid strides. The compound engine, followed by tri-compound, and now by quad-

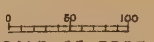
*To compare ancient and modern ships, some sketches and plans are here given. All these are drawn to the same scale for comparison, and show, plainer than pages of description could do the relative sizes of ships then and now.*

THE CUNARDERS "CAMPANIA" AND "LUCANIA."
600 feet long. 13,000 tons. Speed 25¾ English miles per hour.

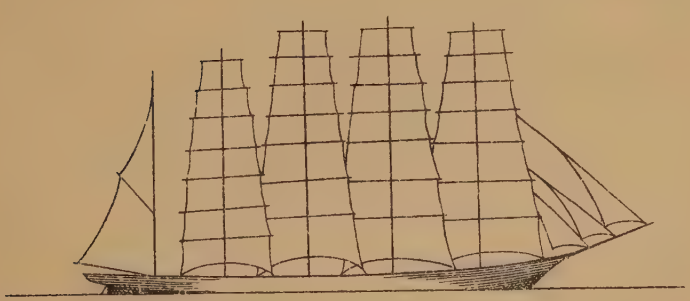
THE "SANTA MARIA," COLUMBUS' SHIP. 70 feet long. 100 tons.
Speed about 6 English miles per hour under favourable conditions.



EAST INDIAMAN "NILE."
1,126 tons. Built in 1850.

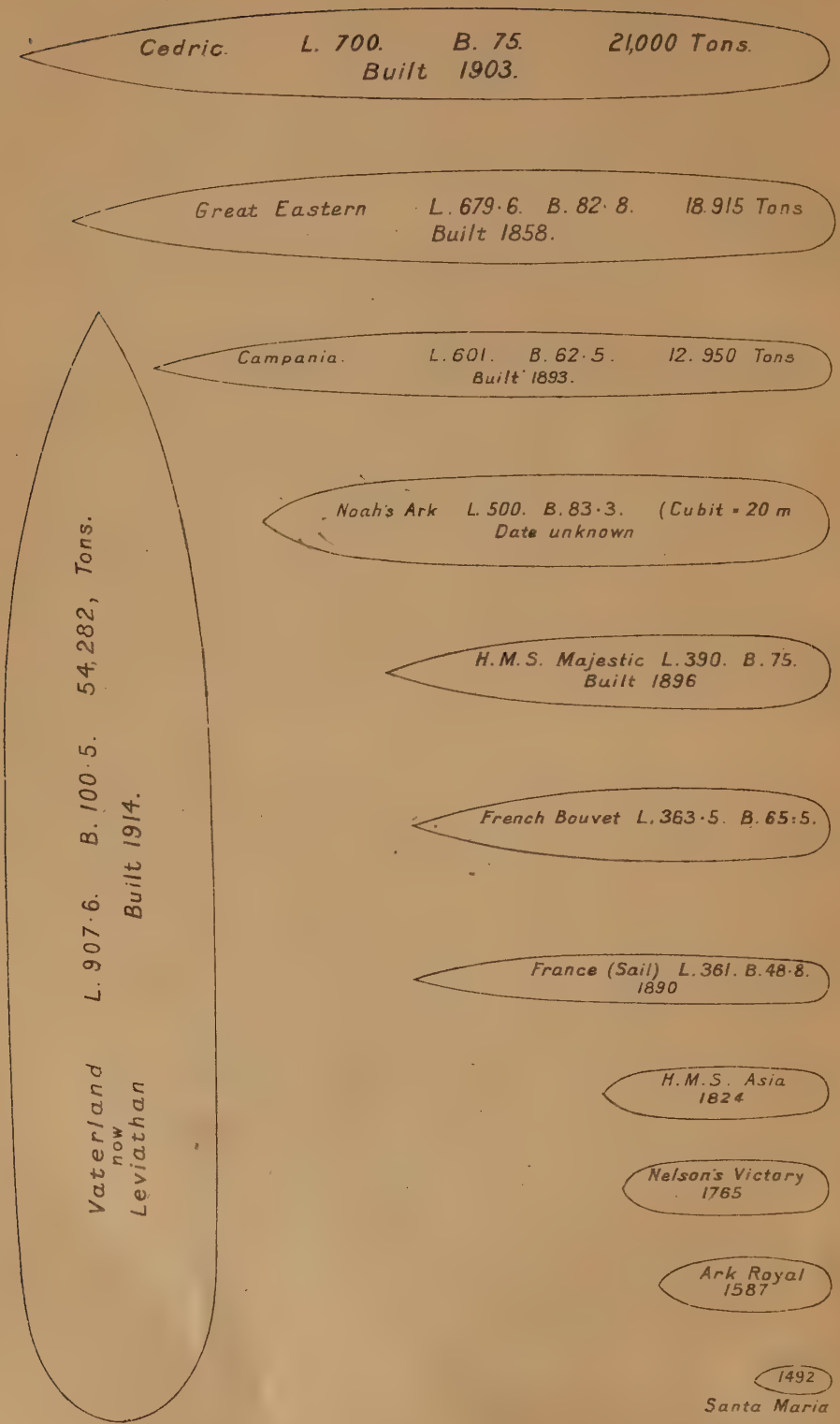



SCALE OF FEET.



FIVE-MASTED BARQUE "FRANCE."
3,784 tons. Built in 1890.

THE "ARK ROYAL."
The Flag Ship of Lord Howard of Effingham,
Elizabeth's Admiral.


Cedric. L. 700. B. 75. 21,000 Tons.
Built 1903.
Great Eastern L. 679·6. B. 82·8. 18.915 Tons
Built 1858.
Campania. L. 601. B. 62·5. 12. 950 Tons
Built 1893.
Noah's Ark L. 500. B. 83·3. (Cubit = 20 m
Date unknown
H.M.S. Majestic L. 390. B. 75.
Built 1896
French Bouvet L. 363·5. B. 65:5.
France (Sail) L. 361. B. 48·8.
1890
H.M.S. Asia
1824
Nelson's Victory
1765
Ark Royal
1587
1492
Santa Maria
Vaterland
now
Leviathan
L. 907·6. B. 100 5. 54,282, Tons.
Built 1914.

ruple engines, have ton by ton decreased coal consumption, until now the most important part of the merchant fleet of the country is composed of steamers. True, there are in the present day larger and finer sailing vessels than ever, many of them being four-masted, but they are in a minority, and are for the most part in the Australian and American Pacific trades.

The present most modern rig of a high-class merchant sailing ship differs from the old type generally as follows :—

The bowsprit has much less steve (that is, has a more horizontal position), and it and the jibboom are usually in one (iron or steel) spar.

The yards are squarer and the hoist less, topsail (and often topgallant) yards being double.

Studding sails are seldom used.

Staysails are carried on every available stay.

The hull is of the clipper form, the old type with *no* sheer and bluff short form having given place to finer lines and good sheer with greater length.

The finest vessels afloat are our magnificent mail steamers running between Liverpool and New York; of these the Cunard "Lucania" and "Campania" make the quickest speed, and, under favourable circumstances, steam over 540 knots per day. But the most celebrated of all is the White Star "Oceanic" (which, until the launch of the same company's "Celtic" of 20,904 tons, was the largest vessel afloat). This splendid steamer's dimensions are :—Length over all 705 feet 6 inches, breadth 68 feet 4 inches, depth 49 feet 8 inches ; 17,274 tons ; 28,000 horse power. She is timed—like a railway train—to arrive (either in Liverpool or New York) on Wednesday mornings, and no attempt at record breaking is made. She is virtually unsinkable, for her numerous water-tight bulkheads are really water-tight, they have no doors in them. No mere collision with another vessel or with an iceberg would founder her ; no gale that ever blew would have any appreciable effect upon her beyond reducing her speed ; she is probably safer than dry land. If necessary she could steam 23,400 nautical miles, at 12 knots, without coaling ; and with her twin engines and propellers she is secure against breakdown ; rendering her admirably suited for her possible employment as an auxiliary cruiser. There is no crowding on board, and so much space is given to each person that of all classes she only carries 1,500 passengers, 350 of which are saloon. Internally she is most beautifully designed and decorated, and externally is like a giant yacht, so that at a short distance it is hard to believe she is such a large vessel. She is without doubt the finest ship ever constructed, and will probably hold this record for many years to come. In 1890 when the first edition of this book was published, such a vessel was scarcely dreamt of; then (1890) there were only four vessels existing over 8,000 tons, and 20 knots was the highest ocean speed. Since then we have more than doubled that size, and now 12,000 tons is nothing out of the way for an ordinary steamer—so fast are we progressing.

Revising this book in the year 1918 the writer feels it incumbent upon himself to leave the foregoing remarks relating to the "Oceanic" uncorrected.

This vessel, performing the duties of an armed cruiser during the Great European

War, was wrecked on the north coast of Scotland in September, 1915, and so ended the career of one of the finest products of naval architect and shipbuilder. The Steamers *Lusitania* and *Mauritania* of Atlantic fame, may be added to the list of vessels remarkable for their size, speed and general costly equipment, but the former met her fate off the south coast of Ireland on May 7th, 1915, sent to her doom by torpedoes fired from enemy submarines.

The consequent loss of life, viz. over 1,500, is too well known to be capitulated here, but we trust that her sister-ship may yet return to her specified duties when the war is over.

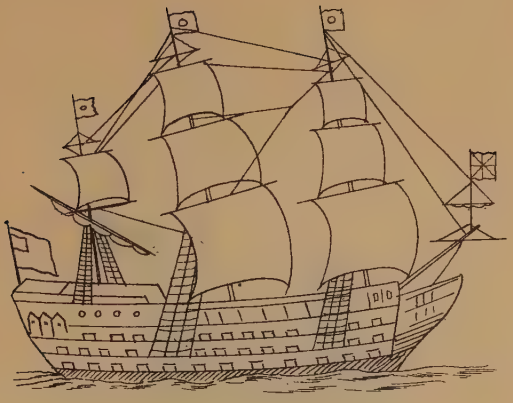
Below are a few particulars of the largest of the well known steamers.

| Name | Gross Ton. | Nett Ton. | Year Built | Length Ft. | Breadth Ft. | Depth Ft. |
|---|---|---|---|---|---|---|
| Oceanic | 17,274 | 6,917 | 1899 | 685·7 | 68·3 | 44·5 |
| Lusitania | 31,550 | 12,611 | 1907 | 762·2 | 87·8 | 56·6 |
| Mauritania | 30,704 | 12,797 | 1907 | 762·0 | 88·0 | 57·0 |
| Aquitania | 45,647 | 21,993 | 1914 | 868·7 | 97·0 | 49·7 |
| *Vaterland | 54,282 | 23,548 | 1914 | 907·6 | 100·5 | 58·2 |

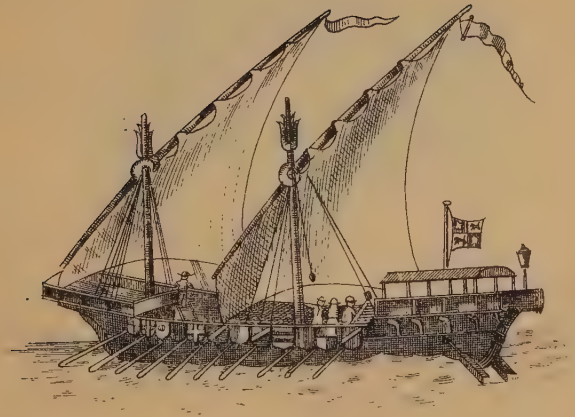
* Re-named the "Leviathan"

GREAT SHIP OF HENRY VIII. After Holbein.

A N.E. COAST COBLE, SHEWING THE BOWLINE.

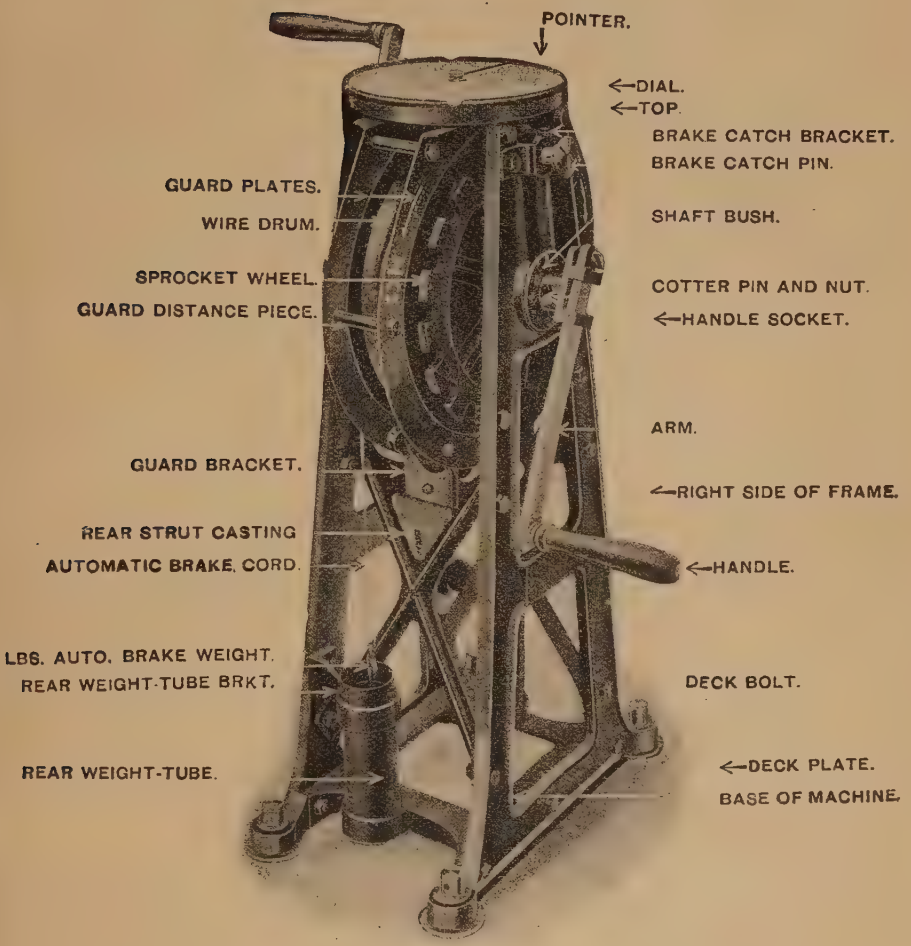


A FIRST-RATE OF CHARLES II. From a Medal.



AN OLD SPANISH GALLEY OF 1630. From an old and rare Spanish work.

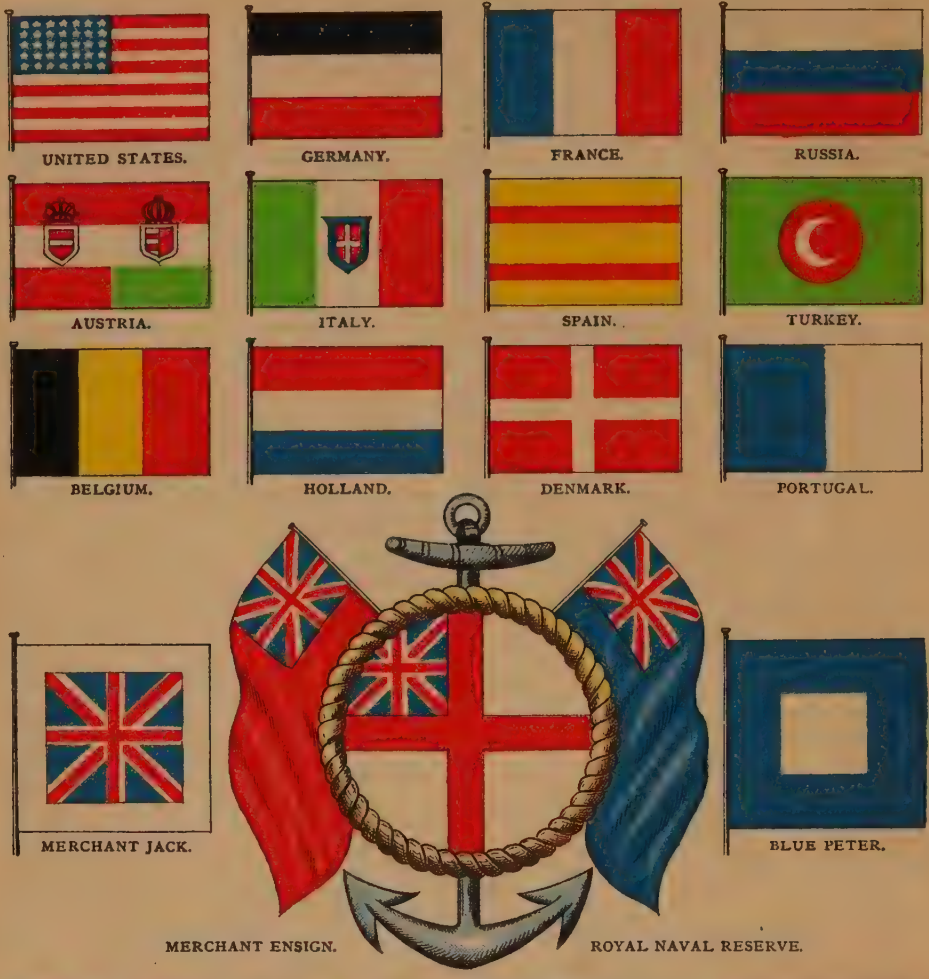
RIGHT HAND SIDE OF MACHINE.




## LORD KELVIN'S SOUNDING MACHINE.

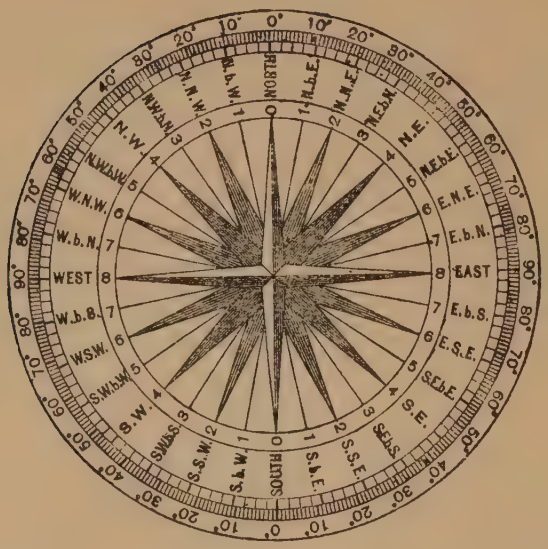
### MARK IV.—HAND DRIVEN.

*Plate No. 26.*




NATIONAL MERCHANT COLOURS.

# MARINER'S COMPASS.




The first thing the young seaman should learn is to "Box the Compass." To do this he should be able to name all the 32 points. It is usual to start at North and work clockwise, *i.e.*, to the right. He should also be able to name any point at a glance. The four principal points are known as the Cardinal Points, and are N., S., E. and W. The next in importance are the Quadrantal Points; these are those midway between the Cardinal Points. They are named by combining the Cardinal Points; they lie between and are N.E., S.E., S.W. and N.W. Having learned these eight points, the others become easy. As it will be seen they are named by combining the Cardinal and Quadrantal Points, *e.g.*, the point midway between N. and N.E. is N.N.E. The remaining points are named "By" Points, and are named by combining the nearest Cardinal or Quadrantal Point with the next Cardinal Point in the direction of the "By" Point required, *e.g.*, the point between N.N.E. and N.E. is N.E. by N.; N.E. being the nearest Quadrantal Point, and the Cardinal Point in the direction of point required is N. The $\frac{1}{2}$-Points are named from either the Cardinal, Quadrantal or "By" Point; never from the points midway between the Quadrantal and Cardinal Points, *e.g.*, the $\frac{1}{2}$-Points between N.N.E. and N.E. by N. is N.E. by N. $\frac{1}{2}$ N., not N.N.E. $\frac{1}{2}$ E. In practically all vessels to-day courses are given in degrees; there are 90° in each quadrant, *i.e.*, between each Cardinal Point. The two principal ones, N. and S., are used first and the other in the same quadrant, secondly, *e.g.*, N. 50° E. and not E. 40° N. The Navy and some of our big liners are adopting another method for giving courses, namely, by using the whole circle, divided into degrees. There are 360° in a circle. North is 0° and 360°; the degrees numbered clockwise. Thus the course East would be 90° S.E. 135°, and so on.

# SEAMANSHIP.

## SECTION I.

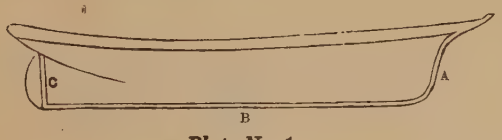
## PRINCIPAL PARTS OF A SHIP.

THE BOW or BOWS.—The fore end of a vessel.

STEM.—The foremost timber or plate of a vessel.

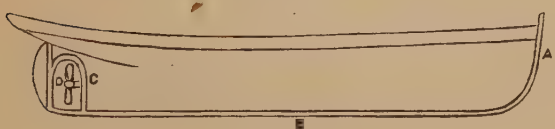
STERN.—The aftermost part of a vessel. "From stem to stern" = the whole length of the ship.

STERN-POST.—The aftermost timber or metal plate of a vessel; except in a screw steamer, where there are two stern-posts. These are generally in one piece or forging, the foremost one being the stern-post proper, the after one, called the after-post, being that to which the rudder hangs, the screw propeller being between the two.




SAILING VESSEL.
*A*. Stem.
*B*. Keel.
*C*. Stern-post.

*Plate No. 1.*




STEAMER.
*A*. Stem.
*B*. Keel.
*C*. Stern-post.
*D*. After-post.

*Plate No. 2.*

HULL.—The whole body of the vessel.

KEEL.—The bottom timber or plate, being, as it were, the back-bone of the vessel, from which the other principal frames or timbers spring.

MIDSHIPS, or AMIDSHIPS.—The middle of the vessel.

FORWARD, pronounced "forrard."—The fore or front end.

AFT.—The stern or after end.

STARBOARD.—The right hand looking forward.

PORT.—The left hand.

AHEAD.—In front of the vessel.

ASTERN.—Behind the vessel.

ABAFT.—Astern or aft of anything.

MASTS are upright spars on which sails are hoisted.

YARDS are spars lying across the masts, to which the square sails are spread or bent.

BOOMS are other particular spars of less importance.

GAFFS are spars which spread the heads of fore and aft sails.

---

SAILS are of two kinds, square sails and fore and aft sails.

Square sails are set from the yards.

Fore and aft sails are set from a stay or gaff

---

Masts of large vessels are not single spars for their full height, but are divided into separate pieces joined together in places. The piece which rises from the hull is termed the lower mast, thus—the fore mast or fore lower mast.

The pieces second in order which are raised on the lower masts are called topmasts—thus, fore topmast. Then comes a third spar, the lower part of which is the topgallant mast—pronounced "t'gallant-mast"—the upper part the royal mast, with sometimes a third part called the skysail mast.

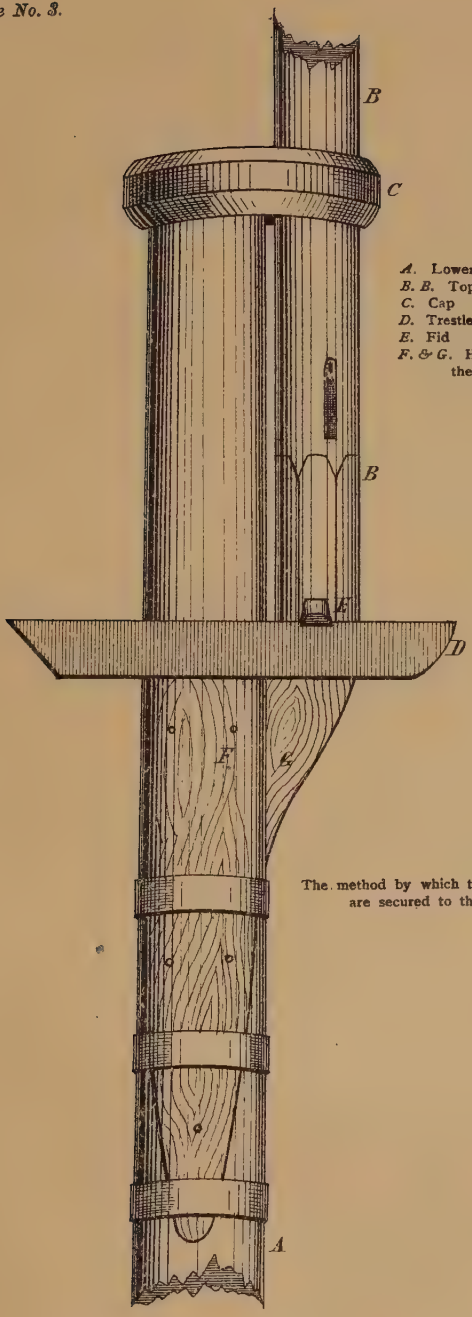
These pieces—lower mast, topmast, and topgallant mast—join each other as follows:—

On the lower masthead (or the top of the lower mast) is fitted what is termed a cap, and, some way below this, pieces of wood, or iron, called trestle-trees. The topmast rests on the latter by means of an iron bar called a fid, and is kept in its position by the cap. (*See Plate No. 3*).

The topmast is similarly fitted at the masthead for the reception of the topgallant mast.

Resting on the lower trestle-trees on a ship's masts is a platform, called a top. On the topmast trestle-trees rests certain jutting out pieces of wood termed cross-trees; these spread the rigging.

*Plate No. 3.*




*A.* Lowermast
*B. B.* Topmast
*C.* Cap
*D.* Trestletrees
*E.* Fid
*F. & G.* Hounds and knees on which the Trestletrees rest.

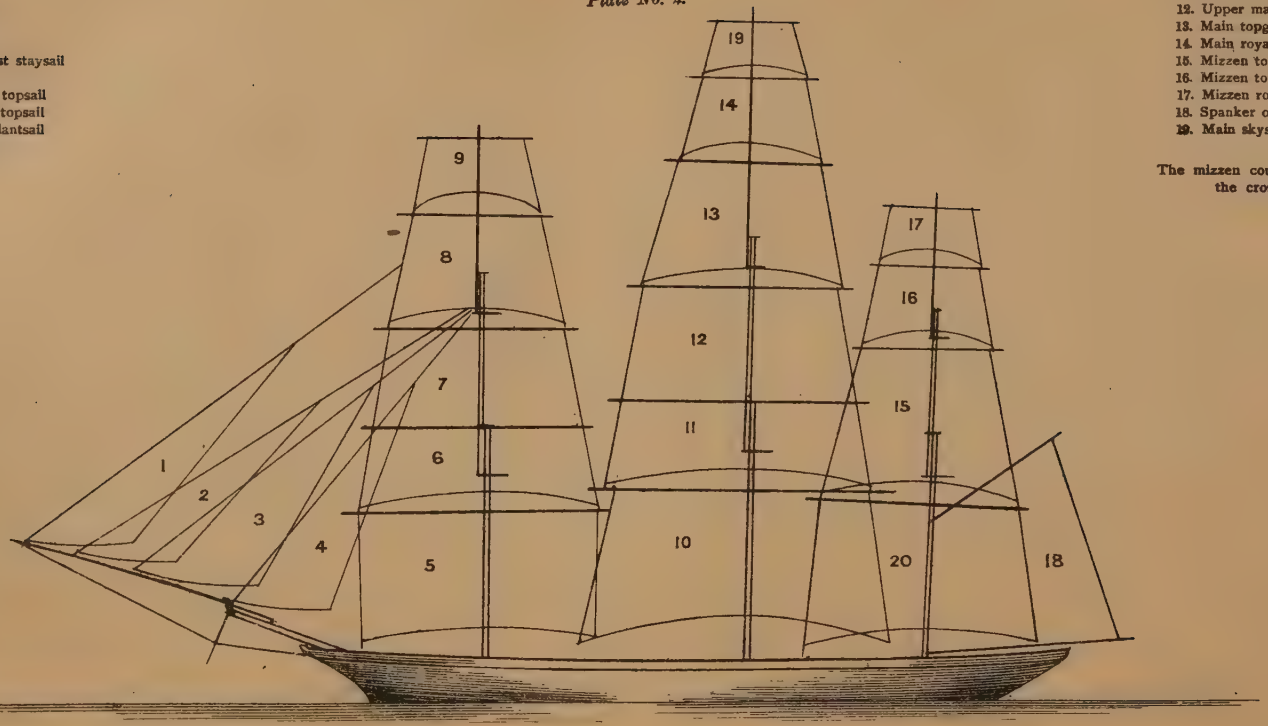
The method by which the upper lengths of a mast are secured to the lower. (Side view)

*Plate No. 4.*

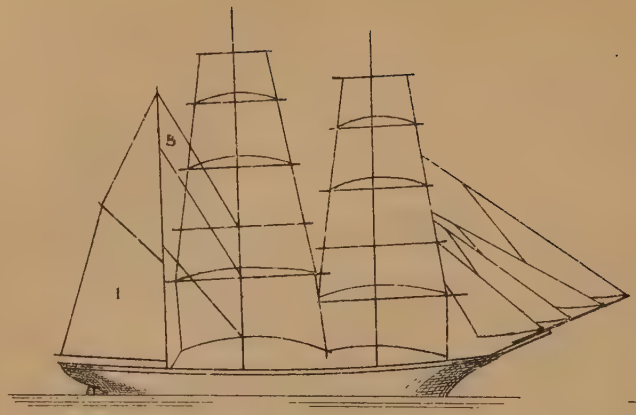
1. Flying jib
2. Outer jib
3. Inner jib.
4. Fore topmast staysail
5. Foresail
6. Lower fore topsail
7. Upper fore topsail
8. Fore topgallantsail
9. Fore royal

10. Mainsail
11. Lower maintopsail
12. Upper maintopsail
13. Main topgallantsail
14. Main royal
15. Mizzen topsail
16. Mizzen topgallantsail
17. Mizzen royal
18. Spanker or Driver
19. Main skysail

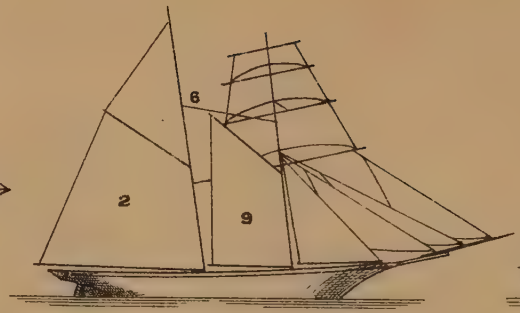
The mizzen course is termed the crossjack.



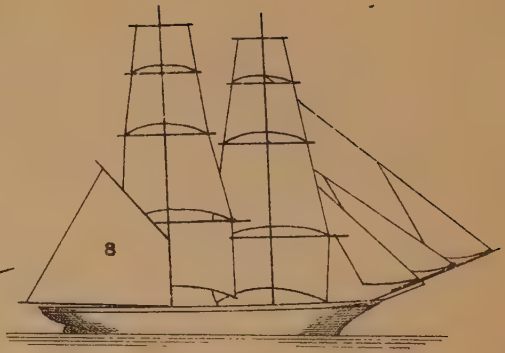

THE PRINCIPAL SAILS OF A SHIP.



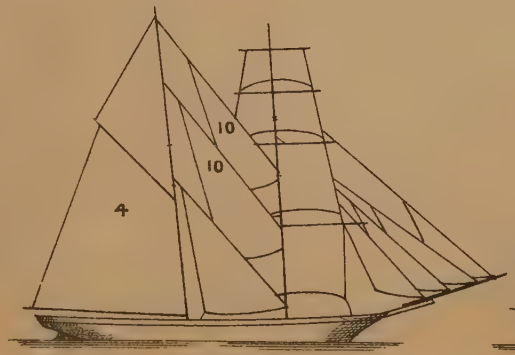

Barque



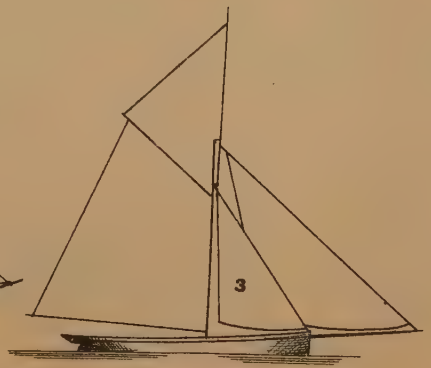

Topsail Schooner



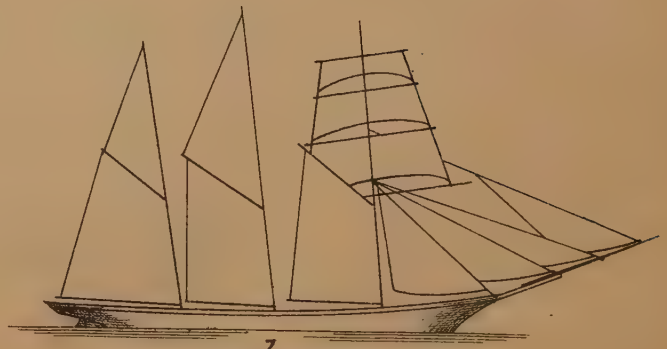

Brig




Brigantine




Cutter or Sloop




Three-masted Schooner

VARIOUS RIGS OF SEA-GOING VESSELS.

## PRINCIPAL SAILS OF A SHIP *(see Plate 4).*

The vessel in the illustration has, it will be observed, double fore and main topsails, but a single mizzen topsail; there are no modern peculiarities in her rig, and she is a good example of the ordinary moderately sized ship of the present day. She carries a main skysail only,—many vessels carry three skysails, fore, main, and mizzen—also double topsails at the mizzen.

Sails are composed of cloths of canvas sewn together, with ropes round the edges to strengthen them.

## RIGS.

The chief peculiarities, in spars and sails, of the principal rigs of vessels are as follows:—

A SHIP has three masts—fore, main, and mizzen, each mast consisting of lower mast, topmast, topgallant mast, and royal mast (the last two being one spar). She is square rigged on each mast, or in other words, each mast carries yards on which square sails are set. In addition she has bowsprit, jib-boom, and flying jib-boom, also spanker boom and gaff. *(See Plate No. 6.)*

A BARQUE has three masts. The fore and main are rigged as those of a ship. The mizzen mast, however, which consists of lower mast and topmast only, with cross-trees instead of a top, carries only two fore and aft sails, called mizzen and gaff topsail. *(See Plate No. 5.)*

A BRIG has two masts—fore and main—rigged like those of a ship, the main mast carrying a fore and aft sail similar to a ship's spanker or driver, called a trysail (8). *(Plate No. 5.)*

A BRIGANTINE has two masts—the fore mast rigged like a brig's, the main mast like the mizzen mast of a barque; the mizzen in this case being the main sail (4). *(Plate No. 5.)*

A SCHOONER has two masts, consisting of lower mast and topmast only, with cross-trees. She carries square topsail and topgallant sail on the fore mast, but no square fore sail. Her main mast is the same as a brigantine's, except that the stays lead differently, and only one staysail is carried. The main sail is like a brigantine's (2). The schooner's foresail sets on the fore-stay, being from this termed 'stay foresail.' The sail which sets from the fore gaff (9) is sometimes termed the foresail, but correctly speaking is the fore trysail.

A FORE AND AFT SCHOONER is similar to the last, except that the

square sails are not carried, the fore mast carrying a gaff topsail as on the main mast.

A CUTTER or SLOOP carries one mast, setting fore and aft sails, her foresail setting on the fore-stay (3).

There are a few other rigs which have slightly differing peculiarities from the ones here mentioned, of which the three-masted schooner is perhaps the most common (7). (*Plate No. 5.*)

A few other minor particulars of these rigs are as follows :—

A Barque's mizzen topmast has two sets of back stays and stays, somewhat similar to a ship's topgallant and royal mast; each of these stays (5) carries a staysail. This is also the case with the main mast of a brigantine, where the staysails are shewn set (10). (*Plate No. 5.*)

The Topsail Schooner, though carrying no square foresail, has a square sail for running free, which sets from the deck. Her mainstay (6), termed a 'jumper stay,' leads from one lower mast-head to the other. (*Plate No. 5.*)

Many large Brigs set their trysail (8) on a small spar, fitted abaft the main mast, for the hoops of the sail and the jaws of the gaff to travel on; this is termed a trysail mast, and brigs thus rigged are called 'Snows.' (*Plate No. 5.*)

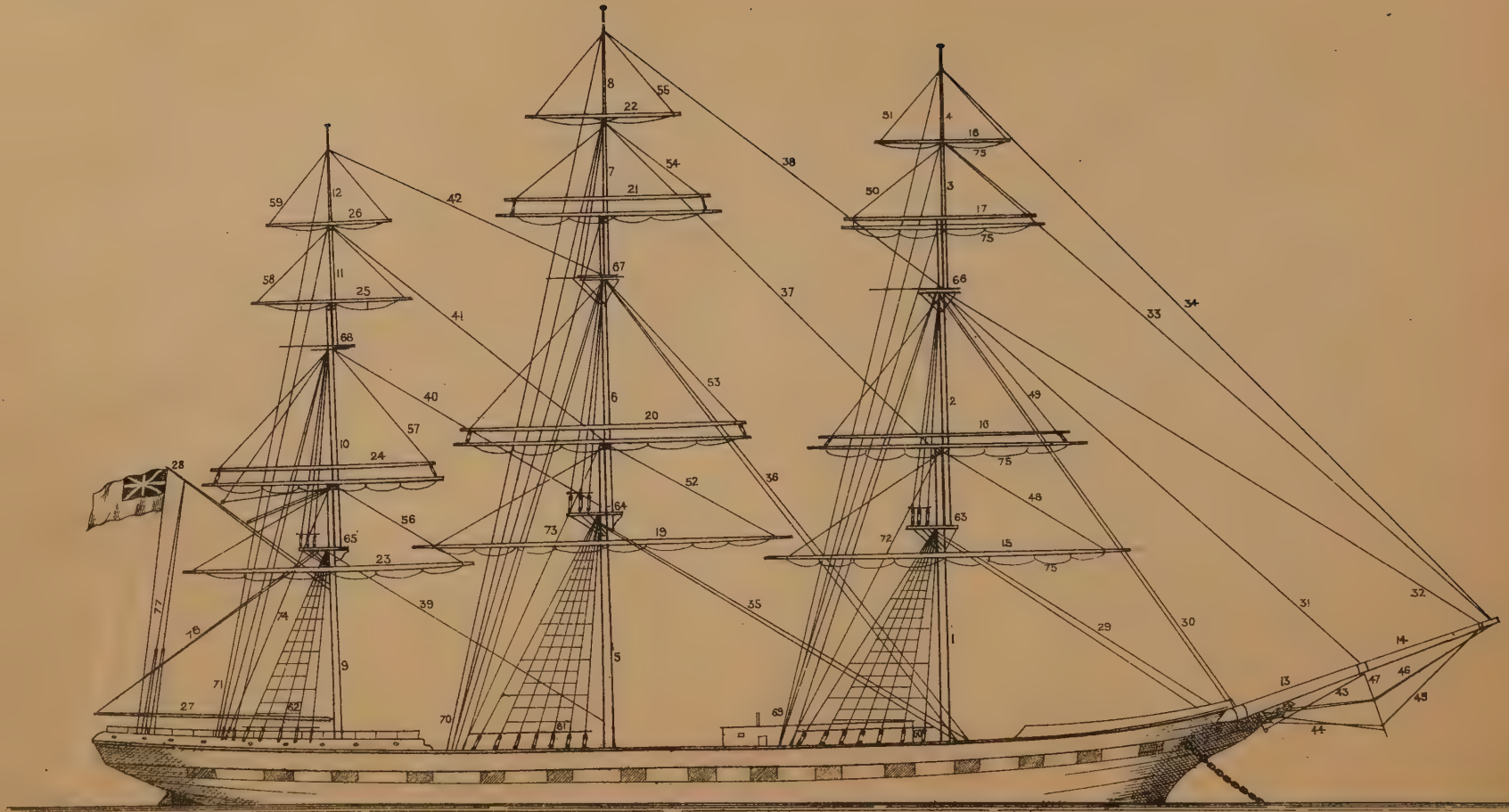
Our modern vessels are now very generally four-masted.

A vessel square rigged on all four masts is a four-masted ship.

A vessel square rigged on the three foremost masts, with a jigger mast fore and aft rigged, is a four-masted barque.

There are a few five-masted vessels. The proper nomenclature for their masts seems to be—Fore, main, middle, mizzen, jigger.

*Plate No. 6.*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## SECTION II.

# PRINCIPAL SPARS AND RIGGING
## OF A MODERN FULL-RIGGED SHIP.

### SPARS.

1. Foremast.
2. Fore topmast
3. Fore topgallant mast.
4. Fore royal mast.
5. Main mast.
6. Main topmast.
7. Main topgallant mast
8. Main royal mast.
9. Mizzen mast.
10. Mizzen topmast.
11. Mizzen topgallant mast.
12. Mizzen royal mast.
13. Bowsprit.
14. Jibboom.
15. Fore yard.
16. Fore topsail yards.
17. Fore topgallant yards.
18. Fore royal yard.
19. Main yard.
20. Main topsail yards.
21. Main topgallant yards.
22. Main royal yard.
23. Cross jack yard.
24. Mizzen topsail yards.
25. Mizzen topgallant yards.
26. Mizzen royal yard.
27. Spanker boom.
28. Spanker gaff.

### RIGGING.

29. Fore stays.
30. Fore topmast stays.
31. Jib stay.
32. Outer jib stay.
33. Fore topgallant stay
34. Fore royal stay.
35. Main stays.
36. Main topmast stays.
37. Main topgallant stay.
38. Main royal stay.
39. Mizzen stay.
40. Mizzen topmast stay.
41. Mizzen topgallant stay.
42. Mizzen royal stay.
43. Bob stay.
44. Back ropes.
45. Jib martingale.
46. Topgallant and royal stays.
47. Dolphin striker, or martingale boom.
48. Fore lift.
49. Fore topsail lift.
50. Fore topgallant lift.
51. Fore royal lift.
52. Main lift.
53. Main topsail lift.
54. Main topgallant lift.
55. Main royal lift.
56. Cross jack lift.
57. Mizzen topsail lift.
58. Mizzen topgallant lift.
59. Mizzen royal lift.
60. Fore rigging.
61. Main rigging.
62. Mizzen rigging.
63. Fore top.
64. Main top.
65. Mizzen top.
66. Fore topmast cross-trees.
67. Main topmast cross-trees.
68. Mizzen topmast cross-trees.
69. Fore topmast, topgallant, and royal backstays.
70. Main topmast, topgallant, and royal backstays.
71. Mizzen topmast, topgallant, and royal backstays.
72. Fore cap shroud.
73. Main cap shroud.
74. Mizzen cap shroud.
75. Foot ropes.
76. Spanker boom topping lifts.
77. Spanker vangs.

### NOTES ON ABOVE.

1. Or Fore lower mast, and so main and mizzen.

13, 14. Iron bowsprit and jibboom in one.

16, 17. Fore topsail and topgallant yards—upper and lower, and so main and mizzen; double topsail yards are all but universal—double topgallant yards not so common.

23. Pronounced crójick.

27, 28. Sometimes termed driver, and, in barques, mizzen.

33. Or Flying jib stay.

43. This is a thick iron bar, bolted to stem and on to band at bowsprit end. This is the modern way of fitting. In many vessels it is of chain, and set up to the bowsprit end with dead eyes and lanyard. In this last case there are two and sometimes three bobstays.
45. Or Jib martingale stay.
49. The lower topsail yards are not fitted with lifts, being supported by the down-hauls to the upper yards.
60. Or Fore lower rigging ; and so main and mizzen.
69, 70. Notice the topmast cap backstav.
72. Or, shortly, Cap-shroud.
75. These are fitted to all yards, and take their name from the yard.

The bowsprit and jibboom are supported sideways by bowsprit-shrouds and jib-guys, which cannot be shewn in the plate, but appear in the plate ( 7 ), showing the fitting of a modern bowsprit.

The ship in the illustration has several modern peculiarities which must be specially noticed. She has a single iron (or steel) spar forward, comprising bowsprit, jib and flying jib-booms in one. The bobstay (43) securing this is a thick iron bar or rod, secured with bolts to stem and bowsprit.

She has double topsail yards at fore, main, and mizzen.

She has double fore and main topgallant yards.

Her yards are squarer—that is, are of greater length, and spread broader sails—than old-fashioned vessels, and she carries no studding-sails (pronounced "stunsails.")

## PRINCIPAL STANDING RIGGING OF MASTS.

THE LOWER SHROUDS, or lower rigging,* is the rigging that supports the lower mast at each side abreast. There are small ropes fastened across these (by clove hitches and seizings) called Rattlines. These are steps for the crew to go aloft by. *(See Plate No. 6.)*

TOPMAST SHROUDS, or rigging, support the topmasts (with the help of the backstays) in a similar manner, but set up to the tops, and do not come down to the hull.

TOPGALLANT RIGGING supports the topgallant mast in the same manner, and is set up to the cross-trees.

BACKSTAYS are the principal support of the topmast, topgallant and royal masts. They lead right down to the hull of the vessel, and set up abaft the lower rigging.

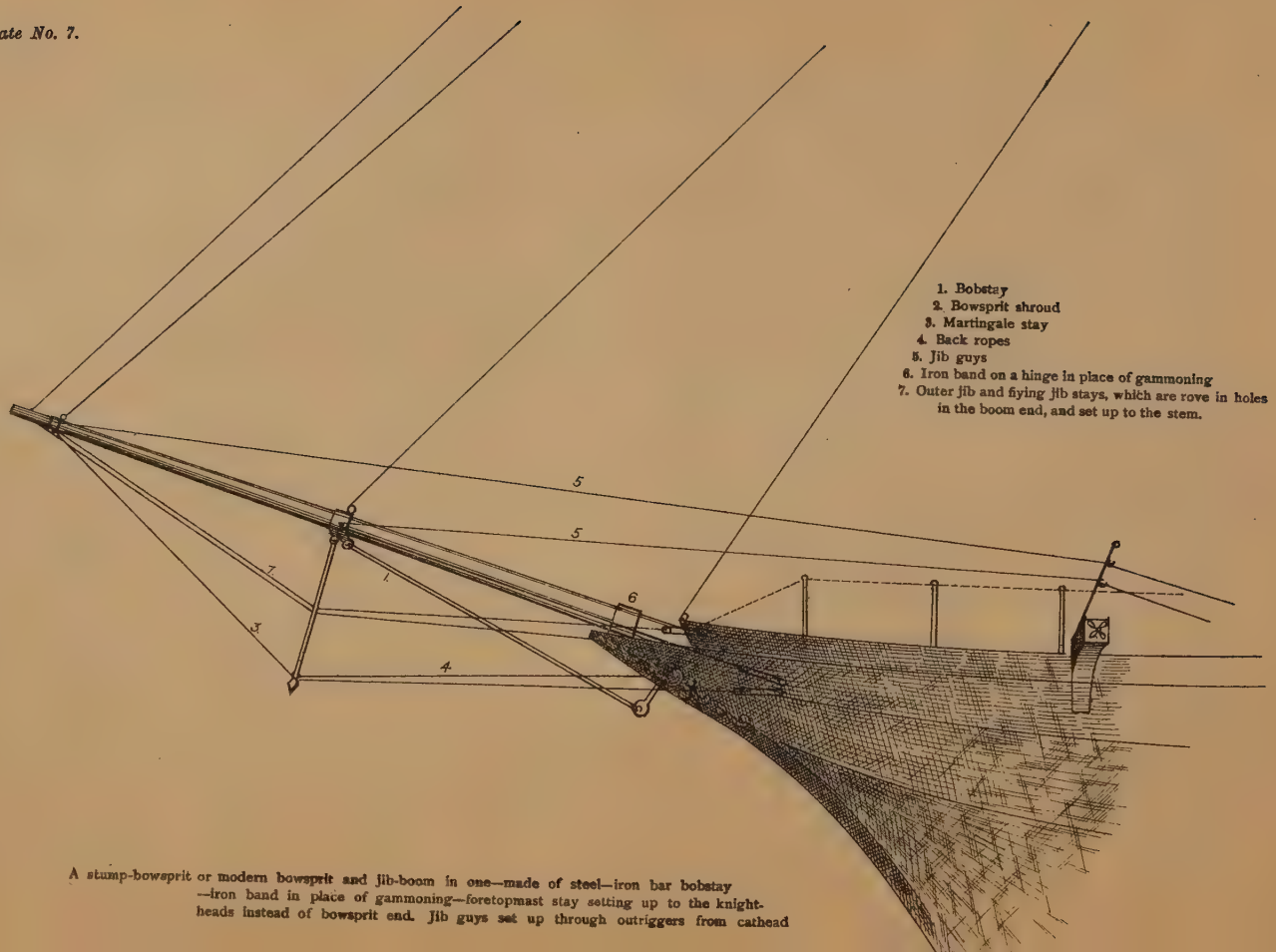
STAYS lead from each mast head forward, and support the masts in that direction.

BOWSPRIT SHROUDS support the bowsprit at each side in the same way that the rigging supports the lower mast. They set up to the bows of the vessel on either side.

BOBSTAYS support the bowsprit from beneath, and prevent it from lifting. They are secured to the stem of the vessel, are made of chain,

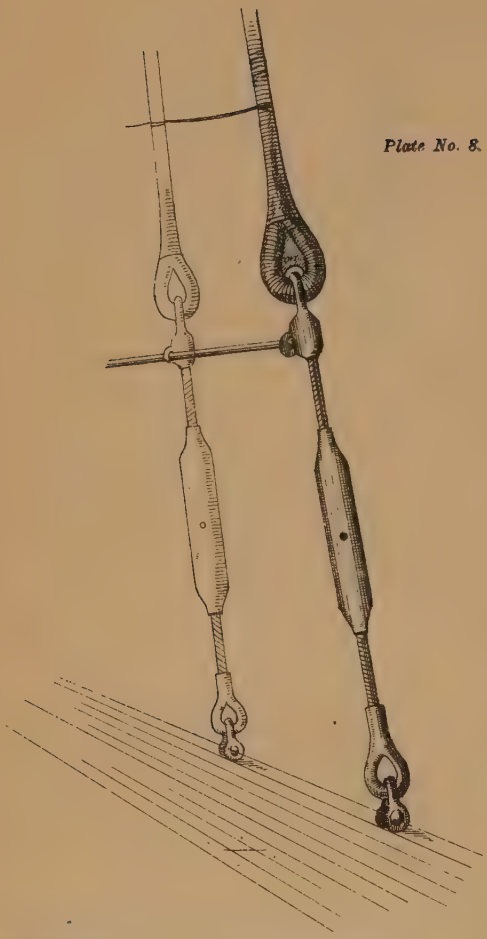
* When *one* is spoken of, it is always called "Shroud," thus, "Foremost Shroud." The *foremost* shroud is also sometimes termed the "Swifter."

*Plate No. 7.*



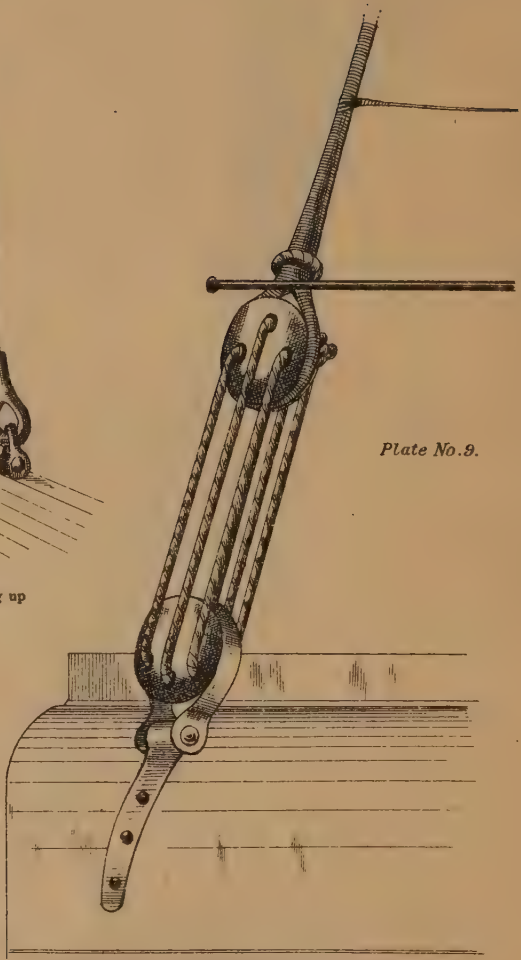

A stump-bowsprit or modern bowsprit and jib-boom in one—made of steel—iron bar bobstay —iron band in place of gammoning—foretopmast stay setting up to the knight-heads instead of bowsprit end. Jib guys set up through outriggers from cathead

*Plate No. 8.*

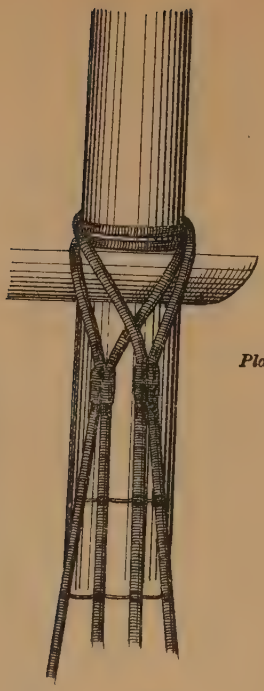


Screws, used instead of dead-eyes and lanyards, for setting up lower rigging.

*Plate No. 9.*



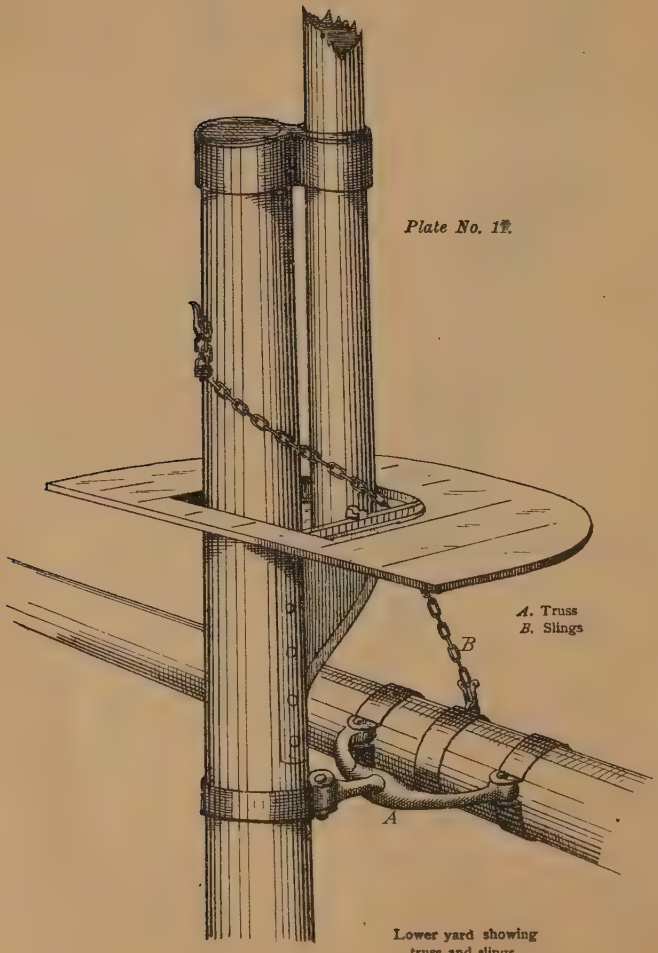
Ordinary method of securing the lower end of a shroud, viz., dead-eyes and lanyards.



The eyes of lower rigging over the masthead. The stay is not shown.

*Plate No. 10.*

*Plate No. 11.*




Lower yard showing truss and slings.

and set up to the bowsprit end by lanyards. Modern vessels have often a single heavy iron rod, or bar, in place of bobstays, which bolts on to the stem and bowsprit end (*as in Plate No. 7.*)

GAMMONING is a strong lashing which secures the bowsprit to the upper part of the vessel's stem; in modern vessels an iron band supplies the place of the gammoning.

JIB GUYS support the jib (and flying jib) boom at each side, in the same way that the bowsprit shrouds support that spar.

JIB MARTINGALE and BACK ROPES.—These, with the help of the martingale boom, or dolphin striker, support the jibboom from beneath. (*See Nos. 44, 45, and 47, in Plate No. 6.*)

Shrouds, stays, backstays, and all standing rigging, are usually set up (or made tight) by lanyards or screws. (*Plates Nos. 8 and 9.*) Shrouds are fitted in pairs, and go over the mast-head with a long eye formed by a throat-seizing on the bight (*Fig. 28, Plate No. 16.*) These eyes do not fit close round the mast-head, but the eye is made long, so that no strain comes on the seizing. The foremost pair on the starboard side go on first, then the foremost pair on the port side, and so on: the stay lashes on top of all, and is not fitted with an eye, but with two forks, which lash together at the after part of the mast. (*Plate No. 10.*)

Wire rigging, set up with screws, has been objected to on the score that it is not possible to "cut away" and relieve a vessel of her spars; but the weather screws can be cast adrift with little more trouble than it takes to cut a lanyard. With steel lowermasts, and topmasts in one, it is a question whether the mast would go over the side even if the shrouds were cut away. The ship *Muskoka* was caught in a typhoon in ballast, and went on her beam ends; the weather screws of the fore-rigging and backstays were come up, but the mast refused to go. The topmast-head was considerably twisted, but sufficed to bring the ship home.

## PRINCIPAL RIGGING OF YARDS.

YARDS are supported by trusses, slings, parrals, and lifts. (*Plate No. 11.*)

TRUSS.—This is an iron fitting which connects a lower yard, or lower topsail yard, to the mast. (*See Plate No. 11.*)

SLINGS are chain strops which help to suspend a lower yard. They are usually secured to a strong iron becket on the after side of the lower mast-head. (*See Plate No. 11.*)

PARRALS secure upper topsail, topgallant and royal yards to the masts.

LIFTS lead from yard-arms to mast-heads, and assist in suspending the yard. In the case of the upper yards they only come into use when the yards are lowered down for the purpose of furling the sail. (*Plate No. 6.*)

FOOTROPES.—These are fitted to all yards, and are, as their name implies, for the use of the crew when getting out and in along the yards. (*See Plate No. 6.*)

The spanker, or mizzen boom, is supported by topping lifts leading from the boom end to the mast-head, under the top or cross-trees.

This concludes the principal standing rigging of a vessel.

## RUNNING RIGGING OF SPARS.

YARDS are fitted with halliards (except lower and lower topsail yards) and braces.

HALLIARDS, secured to the yard amidships, hoist it up and lower it down.

BRACES, fastened to the yard-arms, and lead aft, are used to move the yards as necessary, in order that the sails may be trimmed to the wind. They are also the chief support to the yard in a fore and aft direction.

SPANKER and TRYSAIL BOOMS are fitted with sheets and guys.

BOOM SHEET.—A heavy tackle, fast near the after end of the spar, which supports or binds it down, in a horizontal direction, when the sail is set, and by which the boom is prevented from going further over than necessary.

BOOM GUYS steady the boom at either side when in its required position.

PEAK HALLIARDS hoist the outer part of a gaff.

THROAT HALLIARDS hoist the jaws, or that part of a gaff which is next to the mast on which it travels.

VANGS steady the gaff in the same way that guys steady the boom. *(Plate 6, No. 77.)*

## RUNNING RIGGING OF SAILS.

The principal rigging of a square sail are tacks and sheets, for setting the sail; clewlines, buntlines, and leachlines for taking it in.

TACKS are heavy ropes (or chains) securing the forward clew, or corner, of a course* to the hull of the vessel.

SHEETS secure the after clews of the courses in a similar way; thus the clews of a course are fitted with both a tack and sheet.

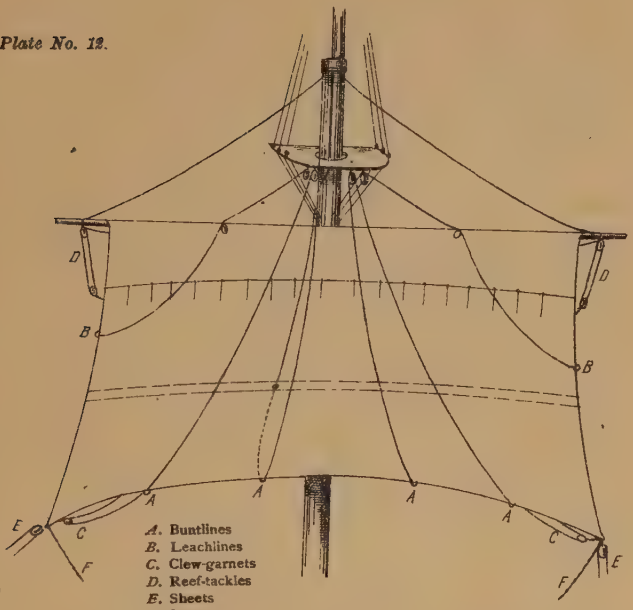
Upper square sails are secured on both sides by sheets. These are of chain, with a rope purchase, and haul the clews of the sails out to the extremities of the yard when set.

CLEWLINES *(Plate No. 12)* (in courses termed clew garnets) are used to pull each clew of a sail up to the yard when it is required to take the sail in. "To clew up" is the term for this operation. *(Plate No. 13.)*

* The lower sails (foresail, mainsail, and crossjack) are courses; sometimes termed, mizzen course, or fore course.

The gear belonging to a course

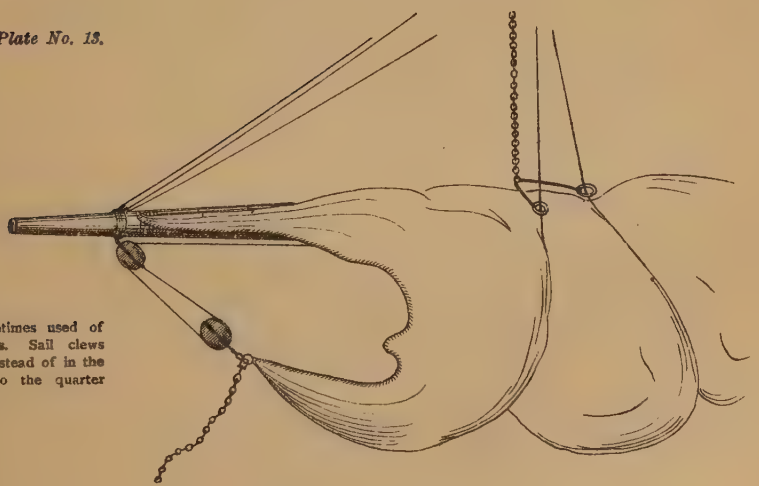
*Plate No. 12.*




*A.* Buntlines
*B.* Leachlines
*C.* Clew-garnets
*D.* Reef-tackles
*E.* Sheets
*F.* Tacks

Note.—Buntlines are sometimes rove, as per dotted line, through bulls-eyes of wood worked into the middle band of the sail.

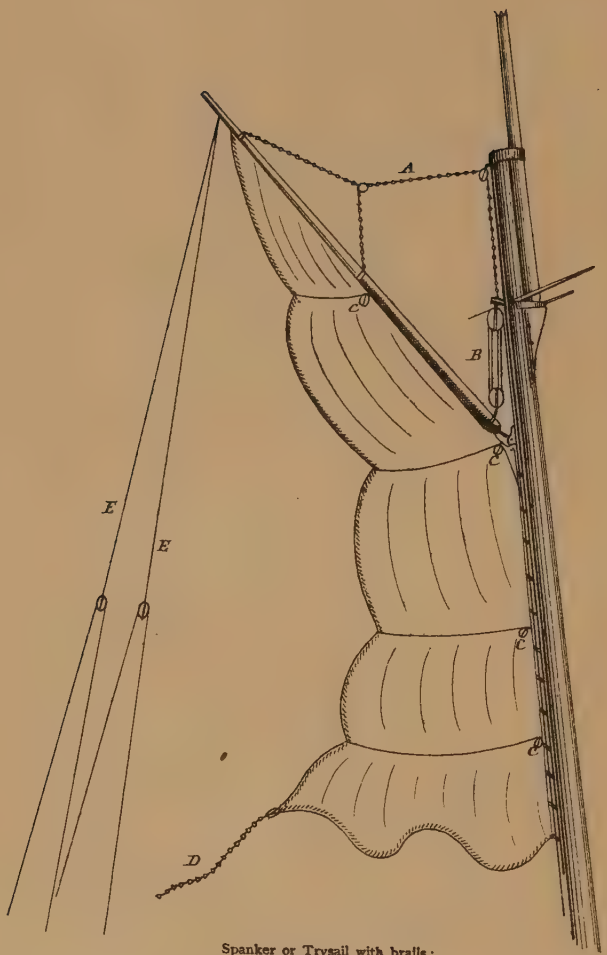
*Plate No. 13.*



Method sometimes used of reeving clewlines. Sail clews up to yardarm instead of in the ordinary way, to the quarter of the yard.

Showing the buntlines rove through lizards

*Plate No. 14.*




Spanker or Trysail with brails:

*A.* Peak halliards
*B.* Throat halliards
*C.C.C.* Brails
*D.* Foot outhaul
*E.E.* Vangs

BUNTLINES pull up the middle part of the sail in a similar manner. These should be fitted with lizards. *(See Plate No. 13.)*

LEACHLINES are used in the same way to pull up the sides, or leaches, of a sail.

REEF TACKLES (nearly obsolete, except for courses) pull up the leach of a course or topsail, to lighten the sail to the men when taking in a reef.

---

The principal rigging of a fore and aft sail, as jib or staysail, are sheets, halliards, and downhauls.

The HALLIARDS hoist the sail up the stay.

The SHEET secures the after clew.

The DOWNHAUL pulls the sail down the stay when the halliards are let go, and it is required to take it in.

Trysails and spankers, or mizzens, are rigged in two different ways.

1. Secured by lacings and lashings to boom and gaff, in which case they have no running gear attached to them, but are hoisted and lowered by the peak and throat halliards, sliding up and down the mast by hoops (or hanks on a traveller). *(Plate No. 14.)*

2. In the other case the sail is permanently secured to the mast, and is hauled out along the boom by a foot outhaul, which is bent to the after clew of the sail. Sometimes the head hauls out the same way, but is more often in sailing vessels bent to the gaff. In sails fitted thus small ropes termed *Brails* are seized to the after leach of the sail, at proper distances, and lead through blocks on the gaff and mast on either side, and gather in ("Brail in") the sail when it is required to take it in.

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## SECTION III.

# ROPES, KNOTS, BENDS, HITCHES, AND SPLICES.

### ROPE.

Rope is usually composed of three parts or strands twisted together.

Wire rope, which is now used for every purpose possible, is twisted up in a similar way, the difference being that the strands of ordinary rope are composed of yarns of manila or hemp, whilst wire strands are made of yarns of wire.

Rope is measured by its circumference.

The coils should be about 112 fathoms in length.

The larger sizes of hemp rope are not often used now—being superseded by wire hawsers.

Rope is laid up in four different ways.

Ordinary way, three stranded, right handed, as in Fig. 32. This used to be termed hawser laid, but has now no distinguishing name.

Shroud laid rope is four stranded, right handed, with a heart in the centre. (*Fig. 33, Plate No. 17*).

Cable laid is three ordinary ropes twisted together, left handed: it has thus nine strands. (*See Fig. 34, Plate No. 17.*)

Water laid rope is three stranded, left handed. (*Fig. 35, Plate No. 17.*)

## KNOTS AND BENDS.

(*See Plates Nos. 15 and 16.*)

There are numbers of knots, bends, and hitches in daily use at sea, which are amongst the first things learnt by the young seaman. These are here shewn in plates, which, if carefully followed, will be of some assistance.

Amongst knots proper the Matthew Walker is almost the only one which it is absolutely necessary for the seaman to know, being used for the lanyards of the rigging.

It is almost impossible to shew by a drawing how to splice. An eye splice is however given as being the most common of all. (*See Plate No. 18.*)

1. Figure of Eight knot. This knot will not jam, as a simple overhand knot will do, if a strain comes on it.

2. Half hitch. This can be followed either by another half hitch above the first, or the end may be stopped to the standing part of the rope.

3. Clove hitch. Principally used for hitching the rattlines to the shrouds.

4. Timber hitch.

5. *a, b, c, d.* To make a bowline knot.

6. Common (or sheet) bend.

7. Reef knot. The ends come out together through the bights; the knot will always hold, and will not jam. This knot wrongly tied, with the ends not coming through the bights together, is termed a "granny," which will not always hold, and if it does, will jam.

8. Round turn and two half hitches.

9. Sheepshank, for temporarily shortening up a rope.

10. Studding sail halliard bend.

11. Studding sail tack bend. This is two half hitches, with the first hitch outside; made thus it will not jam; if hitched in the usual way the inner hitch would not be got adrift so easily.

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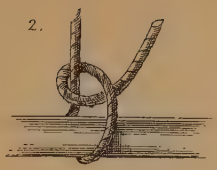

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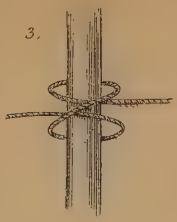

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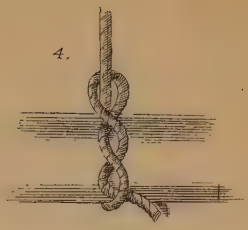

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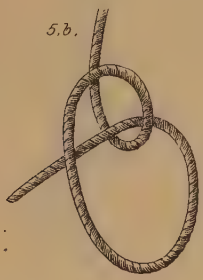

5.c.

5.d.

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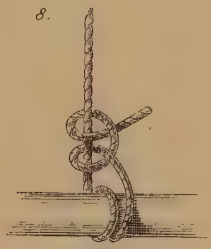

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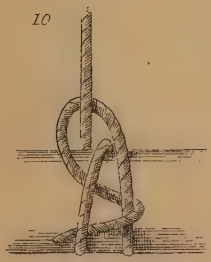

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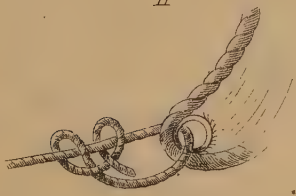

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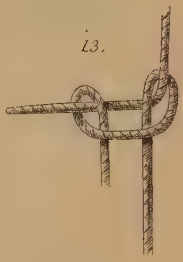
13.



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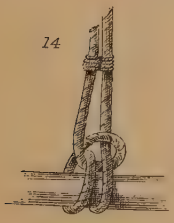

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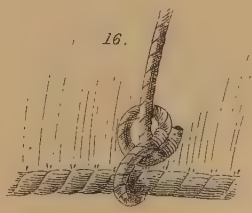

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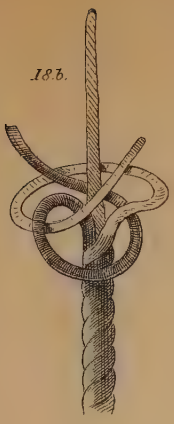
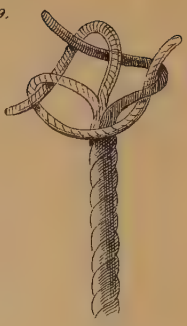
18.a.

18.b.



18 c.

19.



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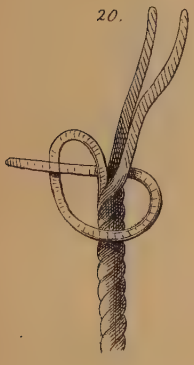


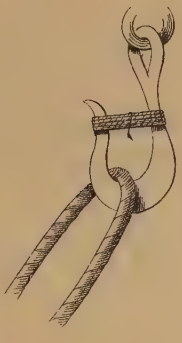
21.

22.

23.

24

25



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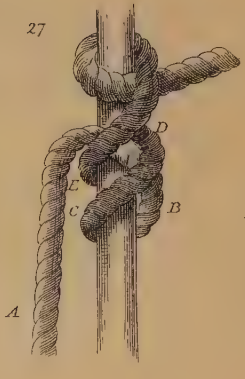


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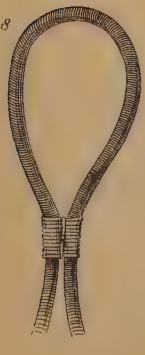

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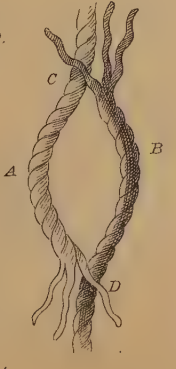



30.

31.

*Plate No. 17.*

32.

Ordinary rope
3-stranded
right-handed

33.

Shroud-laid
4-stranded
right-handed
centre heart.

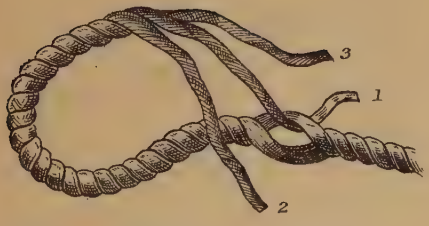
34.

Cable-laid
3 ordinary ropes
twisted together
left-handed.

35.

Water-laid
3-stranded
left-handed.

*Plate No. 18.* THE EYE-SPLICE.

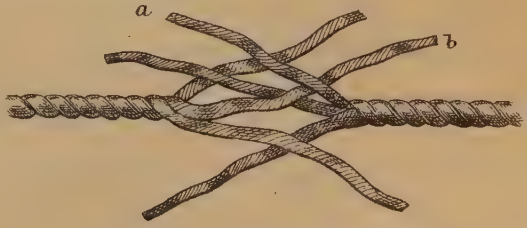



Unlay the strands and place them on the rope so that one strand lies on each side and one on the rope. Take this middle strand and tuck it as in Fig. 1 (No. 1).

Then turn them downwards and take the third strand and tuck it as in Fig. 3 (No. 3) seeing that a strand comes *out* between each lay of the rope.

The three strands are now tucked once more each over one lay of the rope and under the next. Draw tight and the splice is complete.

Take the second strand and tuck it as in Fig. 2 (No. 2).
Draw both strands close and neatly into their place.




To begin a short or long splice, inlay and place together as shewn—alternate strands. Then to continue for a *short* splice draw the two ropes close together and tuck the end of the strands over one and under the next as in finishing an eye splice. To continue for a *long* splice unlay *a*, and lay up *b* in its place, as far as it will go, where splice the two strands together; then inlay one of the other strands the opposite way and do the same. The remaining two are spliced in the middle where they are. These splices cannot be shewn plainly enough in a plate, but must be learnt in practice.

12. Granny, or reef knot tied the wrong way.

13. Reef knot capsized. If a tight reef knot is to be cast adrift one end is taken hold of and pulled towards the other end: the knot will then appear thus, and come adrift easily.

14. Fisherman's bend.

15. Carrick bend, used for bending two hawsers together.

16. A clinch, generally used for fastening buntlines and leachlines on to sails.

17. Bowline on a bight.

18, *a. b. c.* Single Matthew Walker knot, used for lanyards of rigging. The first strand is brought round the other two, and the end laid against the back of its *own* part, as in *Fig.* 18*a*; the second strand is brought round through the bight of the first, and up against its own part (18*b*); the third strand is laid in a similar manner through the bights of the first two strands, and up against its own part; all are then hauled smoothly taut, and the knot completed (18*c*).

19. A single wall, the beginning of ornamental knots.

20. Double Matthew Walker. The first strand is passed round and through its own bight; the second strand is passed through the bight of the first strand and its own; the third through all three bights.

21. Blackwall hitch. For hooking on to the end of a lanyard when setting up gear.

22. Double Blackwall hitch. For the same purpose as the last.

23. Midshipman's hitch. For the same.

24. Cat's paw. For the same.

25. To mouse a hook. This is to prevent it unhooking from whatever it may be hooked to.

26. A single wall knot, crowned.

27. Rolling hitch. For securing the tail of a jigger to a rope, such as a topgallant backstay. *A* is the main part, which is passed round the backstay, following *B, C, D, E,* and then half-hitched above, or the end may be backed round and seized.

28. A Throat seizing on the bight. The shrouds are fitted thus to go over the mast heads; the eye is not fitted close round, but the seizing is put well down, making a long eye. If it were seized too close up, the spread of the shrouds would put more strain on the seizing than it would bear.

29. Cut splice (seamen give this a less decent name). This splice is not often used now. The ropes *A* and *B* are laid together, as shewn; *A* is then spliced into *B* at the point *D*, *B* is spliced into *A* at point *C*.

30. Grummet, used for stropping blocks and various other purposes

Made with a strand of rope just unlaid, with all the turns in it. When the ends come together, take an over-hand knot with them, haul tight, divide the yarns, and stick in as in splicing.

31. Running bowline.

32. Spanish windlass. *(Plate No. 19.)*

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## SECTION IV.

# BLOCKS, GINS, AND TACKLES.

### BLOCKS.

A Block is composed of—

The Shell, or outside part.

The Sheave, the wheel or roller which runs on a pin inside the Shell.

The Pin, on which the Sheave runs.

Blocks are either stropped with rope, or else have an iron strop fitted to them when made.

A Block is measured by its length, and should be *at least* three times the size of the rope which is to be rove in it. Thus a twelve inch block will take a three and a half or four inch rope. *(Plate No. 20.)*

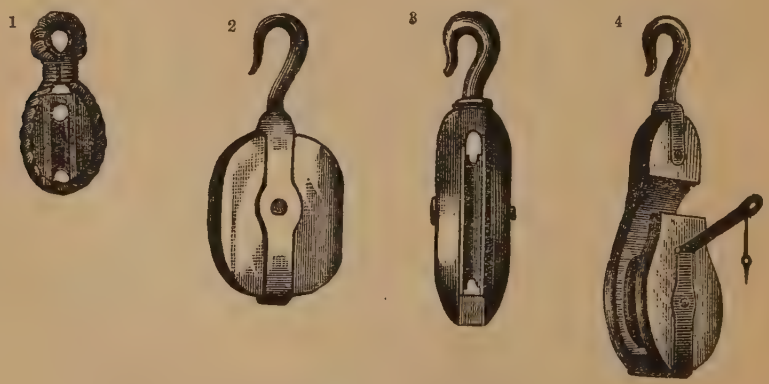
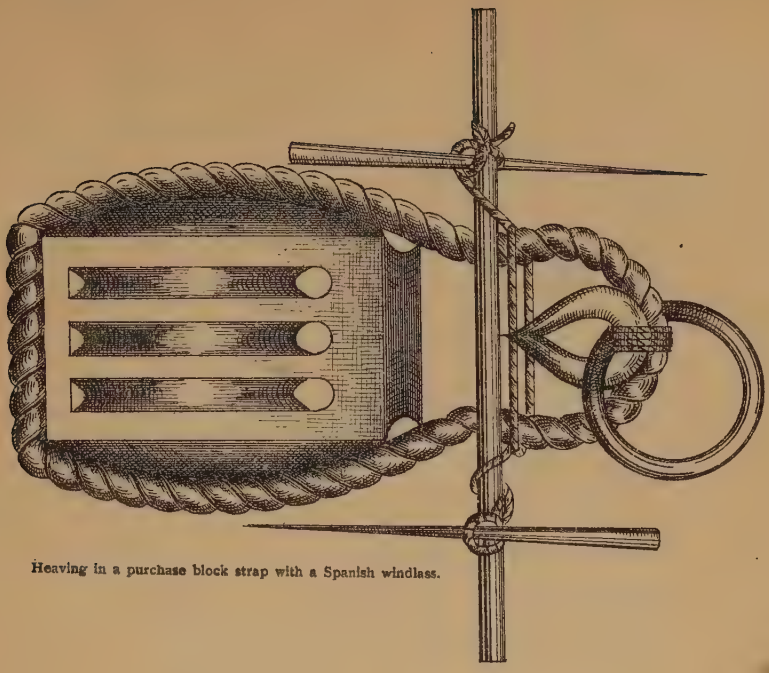
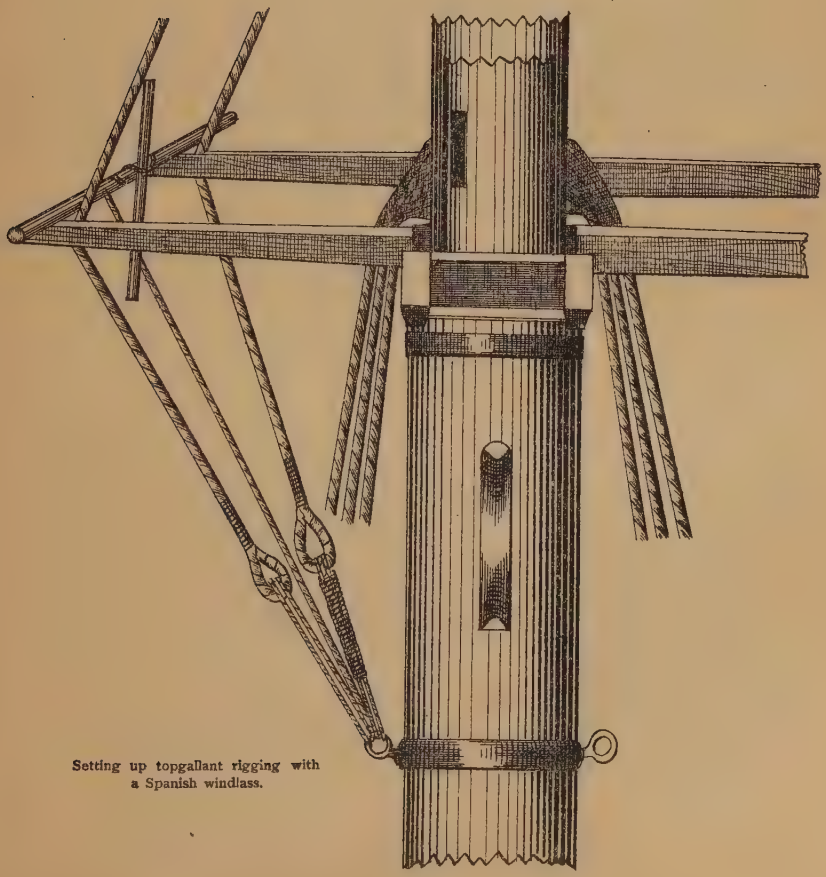



*Plate No. 20.*



Heaving in a purchase block strap with a Spanish windlass.

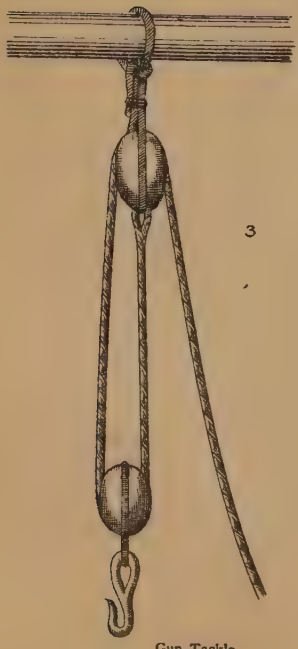


Setting up topgallant rigging with a Spanish windlass.

Single whip.

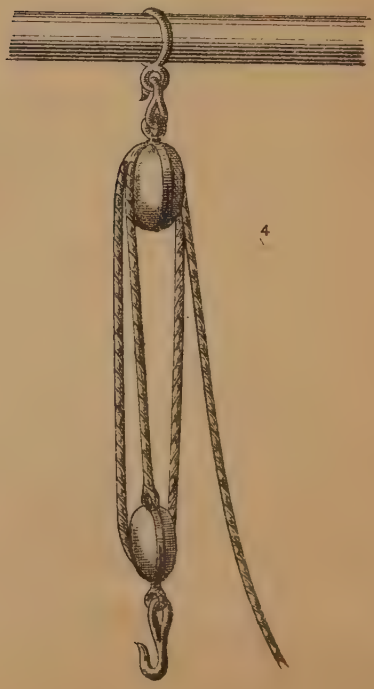
2

Whip and Runner.



3

Gun Tackle.



4

*Plate No. 22.*

A Spanish Burton.

5

5a

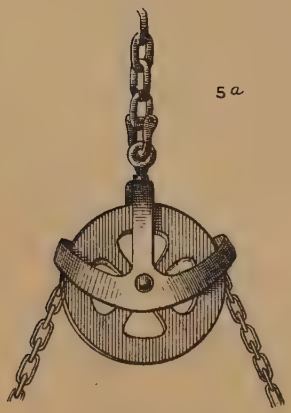


*Plate No. 23.*

6

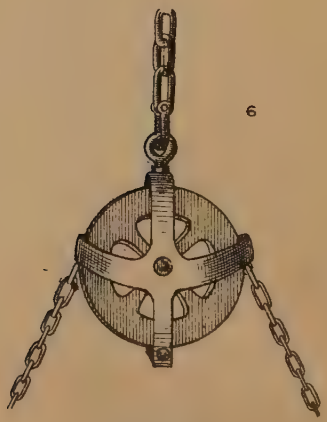


*Plate No. 24.*

*Fig. 1* is an ordinary small block stropped with rope.

*Fig. 2* is a block with an iron strop.

*Fig. 3* is a block with an internal iron strop. The best and neatest blocks are made in this last manner.

*Fig 4* is a Snatch block, sometimes termed a shoe block, from its shape. This block is used for leading a rope to a winch or capstan, or along the deck, so that the men can tail on.

Block strops of rope are made either by a grummet, or else the rope is cut the proper length and spliced.

For a spliced strop measure once and a half round the block, and cut the rope that length; splice the ends together with a short splice, fit it and seize it. If to be served it must be got on a stretch, wormed, parcelled and served as near to the ends as possible; then splice, cut the ends off, and serve over the splice.

## TACKLES.

The most common purchases used in the Merchant Service are as follows:—

Single whip. (*Fig. 1, Plate No. 21.*)

Whip and runner. (*Fig. 2, Plate No. 21.*)

Gun tackle. (*Fig. 3, Plate No. 21.*)

Watch or Luff tackle. (*Fig. 4, Plate No. 21.*)

Spanish Burton. (*Fig. 5, Plate No. 22.*)

The formula for finding the power gained by a tackle is as follows:—

Let $N$ equal the number of sheaves in the *moving* block, the power gained by the tackle = $2N$. Thus the watch tackle here shewn having the double block hooked to the spar, the single is the moving block, so the power gained is twice one, or one man on the tackle has the power of two. If the tackle had been on a rope with the single block hooked to the deck, the power would have been $2 \times 2 = 4$.

A two-fold purchase is two double blocks.

A three-fold purchase, two three-fold blocks.

When using such a purchase as the latter for a very heavy lift, the hauling part should be rove in the middle sheave, so that the heavy strain on that part may be in the middle of the block, and thus prevent it from canting, or the sheave from splitting.

*Fig. 5a* (*Plate No. 23*) is the ordinary cargo gin. This pattern is not the best. There should be a guard, as in *Fig. 6* (*Plate No. 24*) with a

screw bolt in ihe bottom to allow the sheave to be taken out; if fitted thus, and the pin breaks, the guard will bring the sheave up and prevent its flying down on deck and killing some one. It will also prevent the chain from unreeving.

The important parts of a gin are the pin and bush. Steel pins working in metalline bushes are the best. Cheaply got up gins, often supplied in the ship's outfit, have pins and sheaves of inferior quality, which wear through in no time.

Winch-chains, when in constant use, get brittle, and after a time become ureliable for lifting any heavy weight. They ought to be seen to occasionally, the worn parts cut out and replaced, and the whole chain put through the fire and heated.

## SECTION V.

## THE COMMON LEAD LINES.

Sounding Lead.
*Fig. No. 25.*

Every vessel should have some plank in her deck, marked at every fathom, from one to five, purposely for marking her lead-lines.

The hand lead-line in moderate sized vessels is usually twenty-five fathoms in length, but in large and lofty vessels thirty fathoms.

All lead-lines are left-handed lay and consequently must be coiled down left-handed, namely, from right to left on the semicircle away from you looking down upon the deck. The same rule applies when coiling it in your hand as you haul it in from the water. Holding the part coil in your left hand, the movement of the right hand will be, down and out away from you then up and towards you on the upper part of the revolution.

To fit and mark a lead-line, proceed as follows:—After having well stretched the line, splice in one end an eye about eight inches in length, and wet the line. All the marks you put in the line must be tucked in twice through the strands of the line, and each mark should be about three inches in length.

| | | MARKS. |
|---|---|---|
| At | 2 Fathoms ... ... | A piece of leather with two ends. |
| „ | 3 „ ... ... | „ with three ends. |
| „ | 5 „ ... ... | A piece of white calico. |
| „ | 7 „ ... ... | A piece of red bunting. |
| „ | 10 „ ... ... | Leather with hole in it. |
| „ | 13 „ ... ... | A piece of blue cloth. |
| „ | 15 „ ... ... | A piece of white calico. |
| „ | 17 „ ... ... | A piece of red bunting. |
| „ | 20 „ ... ... | A piece of whipcord with two knots. |

Unmarked fathoms 4, 6, &c., are termed deeps.

Note.—The reason for using calico, cloth, and bunting, is that the difference may be felt when too dark to see, and the marks thus recognized.

The deep sea lead-line is marked in the same manner up to twenty fathoms; then for thirty fathoms, three knots; forty fathoms, four knots, and so on up to 100 fathoms. Between each ten fathom the line is marked by a strip of leather, or a single knot, at every five fathoms.

The deep sea lead-line is usually 120 fathoms in length.

It will be noticed that the above directions for marking the lines give the full length of fathoms, but *plus* the length of the lead, this being the customary practice, giving the ship the benefit of the water *plus* the length of the lead.

But this mode of marking the hand lead-line will not hold good in shallow river navigation, where sometimes every inch of water is of value.

For instance, in the Hooghly, the leadsman, the first thing after coming on board, re-marks the ship's lead-lines at every quarter fathom, measuring *in* the length of the lead.

In other rivers like the Indus and Tigris, where the navigation is carried on with vessels of small draft, a twenty feet pole is used, and this pole is painted at every foot black and white, and numbered.

In the River Plate, again, and other places, the pilots use a cod-line and small lead of about 3-lb. weight.

The lower end of every lead ought to have a hollow cavity in it, for the reception of a piece of clean tallow; this is to show the nature of the bottom, by its sticking to the tallow. Seamen term this the arming of the lead.

Being a good leadsman is a thing aimed at by every good seaman, and many men, by constant practice, think nothing of heaving fifteen fathoms of line straight out, with a 7-lb. lead attached.

When heaving the hand-lead you are generally placed outside of the rigging, standing either on the rail, or sheer pole, with a broad canvas belt round your waist, so that you can stretch your body well outside the rail. Take hold of the line about ten feet from the lead, then swing the lead backwards and forwards a couple of times, keep your arm very stiff, then swing it right over your head twice, let go the lead, and give out the line. (The line should be coiled up, and held in the left hand on the starboard side of the ship, and the lead swung by the right hand; but when heaving the lead on the port-side this order of things must be reversed, and the line held in the right hand, and the lead swung by the left.)

If the lead is well hove, it will drop close alongside the vessel well

forward. As the line comes plumb up and down, tap the ground with it smartly, and call out the depth of water.

If it is five fathoms, you call out, *By the mark five;* if it is four, you call out, *By the deep four*, and so on; consequently in twenty fathoms of line there are eleven deeps, and nine marks, or in other words, in nine places the line is marked, and eleven places it is unmarked.

But say you have about 7½ fathoms, you then call out, *And a half seven;* but were the water 6¾ fathoms, you would call out, *A quarter less seven;* or if you had 6¼ fathoms, call out, *And a quarter six*, and so on.

When hauling the line in, coil it carefully in your hand, and make ready for another cast. There is a *right* way of hauling in the line. If you are in the starboard-chains, you haul in with the right hand, pass the left hand under to the waterside of the right, and then haul away on the left. In this way the line will coil itself naturally and clearly in your left hand.

Be careful and make the end of the line fast to one of the shrouds before you commence to heave the lead.

All leads are fitted with a grummet in their upper end; when bending a lead on, reeve the eye splice of the lead-line through the grummet in the lead, and drop the lead through the eye splice, and render the parts of the eye tight.

Good soundings in seven and eight fathoms can be got by a smart leadsman with a vessel going at five or six knots. If the vessel is going above that speed a 14-lb. lead will be found necessary.

A good leadsman is not made in a day, and it requires incessant practice for months to be able to heave out twelve fathoms of straight line, in the *port* channels, and get an eight fathom cast properly.

Commence learning to swing the lead with the 7-lb. one, and when you find you can swing this well, go in for the 14-lb. lead, and *mind your head.*

For getting good and truthful soundings up to ten fathoms, nothing beats a good stout cod-line, marked the same as the hand lead-line, with about a 6-lb. lead on it; it sinks faster than an ordinary hand lead-line, and is much more easily handled.

In former days if a merchant seaman wished to join the Navy, the first order he received from the lieutenant in charge of the deck was, "Go into the port-chains, my lad, and give me a cast of the lead." This shows that being a good leadsman was the first test that authorities in the Navy judged a seaman by.

We will now describe the mode usually adopted in taking a deep-sea cast.

The line must be passed along the weather-side, from out the weather-quarter, outside of all the rigging on the weather-side of the forecastle, where it is bent on to the lead, which has been properly armed beforehand; the lead should be either a 28-lb. or a 56-lb., according to the depth of water expected. Hands should be stationed here and there along the weather-rail, and each man holds a small coil of a fathom or two in his hand. (In case there is much less water than expected, one of these men would take the soundings roughly, but it would then have to be verified by another cast, with less line passed along from aft.)

With the wind on the beam or thereabouts, and all plain sail being set,—which indicates that the breeze is a moderate one—lift the clews of the mainsail and haul in the slack of the leach-lines and outer buntlines.

Put the helm down gently and bring the ship's head slowly to the wind but not sufficiently to get the square sails on the foremast aback.

When all the square sails are on the shake, haul round the main yards, and if a full rigged ship the cross-jack yards as well and at the same time.

Do not try and haul round the yards mentioned when clean full and a stiffish breeze blowing, as much extra power is required to do so and such is wasted energy, more especially when the ship is not over-burdened with seamen.

Watch the helmsman and ease the helm when necessary, so that the fore yards may take to full again.

Many shipmasters do not trouble to back the main and cross-jack yards but shake the ship well up into the wind and get the way off in that manner.

The ship's headway being stopped or deadened, the master or officer of the watch takes hold of the line on the quarter, and calls out "Heave!" The man on the forecastle then heaves the lead, well to windward, overboard, and as it comes along the side, each man lets the line run through his hands, calling as he does so "Watch there, watch!" as a signal to the next man along, and the officer aft plumbs the line, giving the lead two or three taps on the bottom, and notes the depth.

The line is then rove through a small snatch-block kept for the

purpose, the lead hauled on board, the line unbent, and the lead carried to the master, for him to inspect the nature of the bottom; for it is generally admitted amongst seamen that when either a steamer or a sailing ship is stopped for soundings, night or day, it is the duty of the master to be always on deck at such times, and inspect the lead.

*Never trust to one cast,* as the lead may have fallen in a deep but narrow fissure in the bottom that is unmarked on the chart, but always verify it by another cast.

If leading in the vicinity of a coast, never run far between casts; and if in command of a vessel, and much depends on the soundings, *trust to no one,* but take the cast yourself.

With the wind right aft the method of actually heaving the lead is the same as previously described, but that of heaving the ship to must be varied.

The strength of the wind and the height of the sea must be taken into consideration, for if the sea is at all heavy, great care must be taken that the ship is not brought round too quickly.

In a moderate breeze the fore yards should be hauled forward and trimmed to that tack on which it is desired to bring the wind and the main yards being left squared the sails will catch aback, so taking the way off the ship before heaving the lead.

The helm is put down and the ship's head brought round until the wind is a little on the fore part of the beam, and as soon as the way is deadened, heave the lead in the same manner as in the case of "Wind on the beam."

If, however, the sea is rough and a gale blowing, the necessary sails must be taken in before bringing the ship round to the wind. The area of canvas set and the amount to be reduced must depend upon prevailing conditions; but it must be remembered that wind pressure on the canvas when a ship is running before the wind as compared with the pressure when the ship has the wind on the beam are two very different things.

For purposes of better illustration we will imagine a ship steering N.E. and entering the chops of the Channel. A strong S.W. gale is blowing, accompanied by heavy squalls and the consequent rough following sea.

First we must consider the tack upon which to heave-to upon, and there is no hesitation in making it the starboard one, for with weather such as described the wind may jump round to the N.W. in a squall.

If, therefore, the ship was hove-to on the port tack and the wind so altered from S.W. to N.W., viz., from left to right, it would mean that the sails would be caught aback and a force acting on all material aloft from a very point on the fore part of the beam that is least protected, so far as rigging and stays are concerned.

The result might be a loss of rope, canvas, and, or, even something more serious.

Having therefore decided upon the starboard tack, lower the upper topsails to the cap—if they were set—and haul the buntlines well taut.

Clew up the foresail and haul all gear taut as if for stowing the sail.

Brace up the fore-yards as for the starboard tack and see all braces and running gear secured, so that they will not get washed through the scuppers if seas come aboard.

If the main braces are worked from the main deck, brace up the main yards before bringing the ship to the wind, but if they lead to the poop as well as the cross-jack braces this can be done as the ship is brought to the wind.

Clear all hands off the main deck : the two ends of the ship are generally the safest places to be in when a ship is broaching-to in a heavy sea.

Place a spare hand at the wheel and bring the ship to the wind gently.

After the necessary number of casts have been taken, put the helm up, square away on the after-yards as the ship's head pays off, and when before the wind again the fore-yards can be squared, braces hauled well taut, sails set as required, and see all gear coiled up and secured.

In the case of being already hove-to and a cast is required, no alteration of yards is necessary.

The amount of way upon the ship will be a negligible quantity, in fact the drift is almost bodily to leeward, so the lead-line after being passed forward outside of everything should be taken round the bow in such a manner as to be outside all head-gear ; then after bending on the lead, stand by for the order to "Heave" and cast it to leeward from the lee bow.

When hove-to the ship's head varies in direction by two or three points, and the most appropriate time to heave the lead is when the ship's head has come up as far as it is expected to come, so that when falling off again it will bring the stern more over the lead.

## PATENT SOUNDING MACHINES.

It is only natural that with the general advance of steamships, some improved instruments for taking soundings without stopping vessels should come well in evidence. There are several kinds on the market and in use, each of which has its own merits no doubt, but the principle is the same.

Not only is it a case of saving time, for with modern sounding machines rapid soundings can be taken, but the results are more accurate, and when it comes to a specified course and distance to be run between each sounding, which is a common form of navigation in a fog, the old fashioned methods of stopping a ship to take a cast of the lead is rapidly going out of practice. Most well equipped steamships are now supplied with some patent sounding device, and not a few with motor power attached for heaving in the lead on each occasion. Perhaps the best known and the most used are those invented by Lord Kelvin, and known as the "Kelvite" sounding machines. I am indebted to the makers, Messrs. Kelvin, Bottomley and Baird, Ltd., for the illustration of their Mark IV. pattern, which can be used in conjunction with a motor attached. *(See plate No. 26. Page XVIII.)*

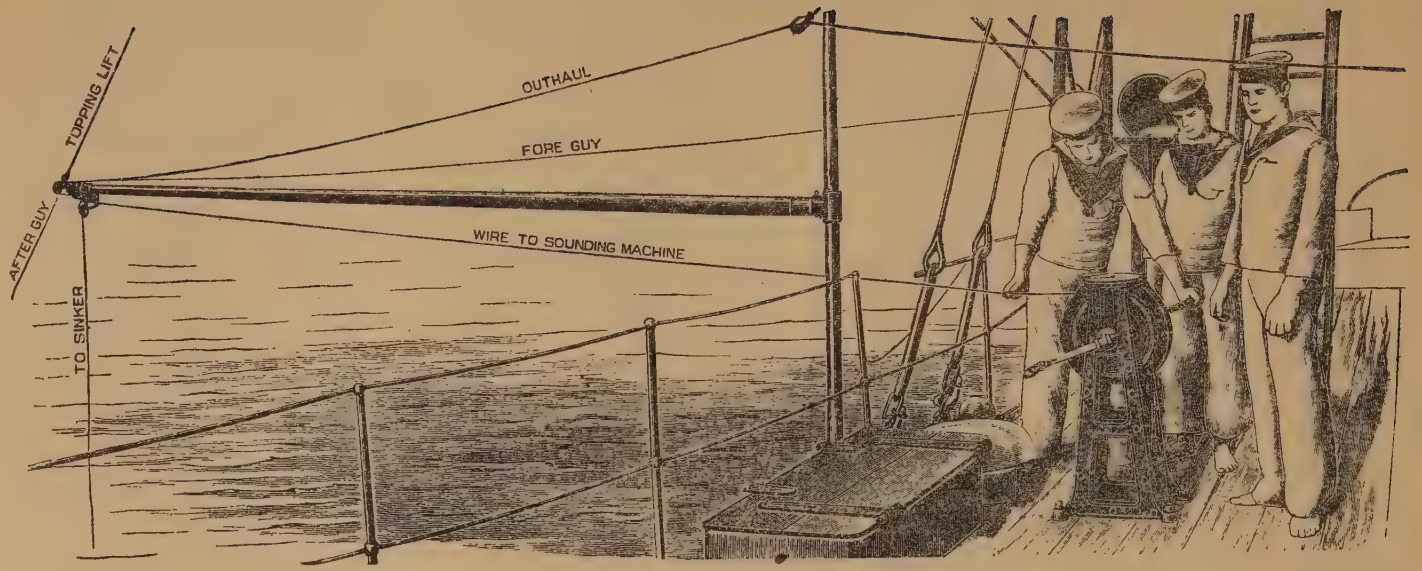
The machines can be placed for use either aft near the taff-rail or amidships, which, being nearer to the navigating bridge, is a very great b nefit.

In the case of the latter positon being selected *(see plate 26a)*, it would be necessary to rig out a boom projecting at right angles to the side of the vessel.

Studying the plate mentioned will give the reader a better idea of the general equipment than a page of foolscap with written explanations, although a few words on the general managememt of the machine is necessary.

Like most mechanical devices it is imperative that it should be kept clean, well oiled and free from the grit, dirt, and other such clogging material that the deck of a steamship cannot be at all times free from. First and foremost then, see that a good canvas cover is made for and kept secured over it when it is not in use, and do not let the cover be too tight but so plain and simple that it can be removed at the shortest notice. I myself have seen covers made that to all appearances were about perfection, but those same covers on a wet and dirty night

*Plate No. 26 a.*




SOUNDING FROM THE FORE BRIDGE—WIRE RUNNING OUT.

had a canvas-shrunken grip on the machines that took some force to remove.

Referring to *Plate 26, Page XVIII.* for a general description of the sounding machine, the principle parts can be picked out by the printed references attached.

The wire drum has coiled upon it 300 fathoms of either strand or piano wire and to the outer end of this wire a 24 lb. malleable iron sinker is attached, although between sinker and wire is a 9 foot length of braided line similar to that used in connection with patent logs. To this braided line is lashed either the "Depth Recorder,"—both ends being secured,—or a "Guard Tube" for the insertion of a small glass tube when that method of sounding is used, both of which will be further explained later on. On the top of the machine can be seen a dial with a pointer attached, and this pointer registers the amount of wire paid out.

If the machine is fixed to the deck aft there must be a clear straight lead for the wire which runs over a specially constructed sheeve fitted with guards to prevent it from jumping off, and in the hands of an inexperienced leadsman this is inclined to occur when the sinker touches the bottom of the sea.

To counteract this there is an automatic brake consisting of a cord passing over a V shaped groove on the side of the drum. The cord is attached to weights working in tubes, of which the inside weight is 6 lbs. and that nearest to the ship's rail 1 lb.

The automatic brake prevents the wire from over-running and ensures that the resistance against the wires when running out is always constant for all speeds of the ship.

Referring again to the "Depth Recorder," this brass tube contains a spring and a marker.

As the sinker descends the increased pressure of water forces a piston up the tube, whilst the spiral spring pulls the piston back.

The amount that the piston is forced up against the action of the spiral spring depends upon the depth of water. As the Recorder goes down the marker is pushed along the piston. When the Recorder is brought to the surface of the water the piston comes back to its original position, but the marker remains at the place on the scale to which it was pushed, and shews the depth to which the Recorder has been.

The depth is read off by the marker.

Another method is by means of a small glass tube sealed at one end

and open at the other. The inside of the tube is chemically prepared, and salt water coming into contact with the prepared part converts it from a reddish colour to a dirty yellow.

The small glass tube is placed inside of a brass one, the former having the open end down and when in, is kept in position by a cap fitted over the open end of the brass tube.

This brass tube is lashed to the braided line between the sinker and the wire in a manner similar to that referred to in the Depth-Recorder.

As the sounder and tubes go to the bottom the water enters the open end of the glass tube and compresses the air. The deeper the water the more the air is compressed, and consequently the farther the salt water progresses up the glass tube, so disfiguring the chemical—nitrate of silver.

When the sounder is brought to the surface, be careful how you handle it so as not to break the glass and also keep the glass tube in a vertical position open end down when you remove it from the brass one.

Supplied with the sounding machine is a two-sided wood scale with fathoms graduated upon it, and to this scale the used glass tube is referred, with the sealed end placed up against the top and the glass resting in the junction of the two sides.

The reading in fathoms opposite to the intersection of coloured and discoloured chemical shews the depth beneath the surface that the Sinker must have gone to.

The pointer on the dial previously mentioned will indicate the amount of wire that has been paid out, but the leadsman must be careful to see that it is set at zero when the sinker is at the rail before being let go, and the reading must be taken directly the wire indicates that the sinker has touched bottom.

This dial is frequently used without the use of "Depth Recorder" or "Glass Tube," but as the amount of wire paid out varies with the speed of the ship reference must be made to a "Table of Depths" supplied for the purpose.

The actual working of the machine is quite simple, but like all such mechanical devices a little practice is necessary, and no novice should attempt to undertake a sounding with it without having previously assisted others with more experience.

Lower the sinker to near the surface of the water,—weather

conditions permitting—by means of the handles, which in all cases should be shipped before putting the sinker over the rail.

A sharp half turn of the handles in an opposite direction to that as when heaving-in will release the main brake and down the sinker will go. Directly it touches the bottom, turn the handles in a heaving-in direction; the main brake acts at once and the heaving-in is a simple matter.

One seaman heaves in with both hands, and the other uses one hand on his handle whilst with the other he guides the wire on the drum by means of a hook or a piece of greasy rag or canvas.

## SECTION VI.

# THE COMMON LOG.

The machinery of the Hand Log consists of a line wound on a reel and a sand-glass. The glasses that are used run, one 14 seconds, the other 28 seconds. To find the length of line required to correspond with these glasses, the rule is, add a cipher to the seconds of the glass and divide by 6; this gives the feet; the remainder multiplied by 2 will give the inches. Thus—say the 28-second glass—280 ÷ 6 = 46, and the remainder 4 multiplied by 2 gives 8. Total 46 feet 8 inches, the length of a knot, corresponding to the above named glass.

The principle of the log-line is that a knot bears the same proportion to a sea mile that a 28-second glass does to 1 hour of time.

Log-lines are commonly (in fast sailing vessels) 75 fathoms in length; this allows the log to have 15 fathoms of stray line, and record the vessel's speed up to 15 knots when using the 14-second glass.

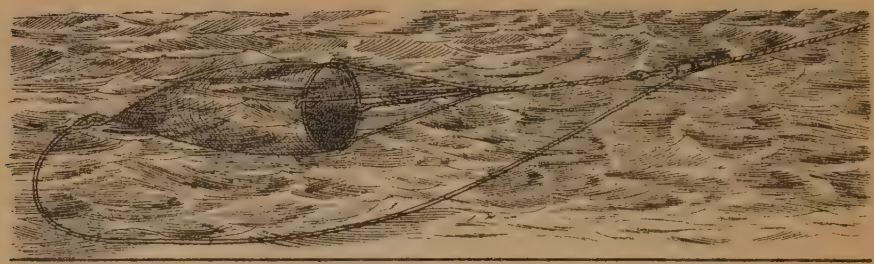
Take a new coil of line, stretch it well, and soak it in water before commencing to mark the line, to allow it to take up, as you must remember the line is always wet when in use.

Measure off 15 fathoms (if she is a large vessel 20 fathoms) and stick in through the strands of the line a small piece of white calico, about 3 inches in length, and secure it well by a couple of stitches with a palm and needle; up to this mark is termed *stray line*, and its use is to allow the log ship, or bag, to get clear of the eddy in the vessel's wake previous to turning the glass.

From the calico mark divide the line into lengths of 46 feet 8 inches each. On the first length stick in a piece of leather for 1 knot, on the second length stick in a piece of whipcord with 2 knots in it, the third length 3 knots, and so on up to 8 knots. Half-way between each of these knots, stick in a small bight of whipcord; these bights record the half knots of the ship's run with the 28-second glass, and a full knot with the 14-second glass. When the vessel is going under 5 knots use the 28-second glass, when going above 5 knots use the 14-second glass; but do not forget that when the latter named glass is

*Plate No. 27.* THE LOG BAG.

1. Log being hove.



2. Log being hauled in.

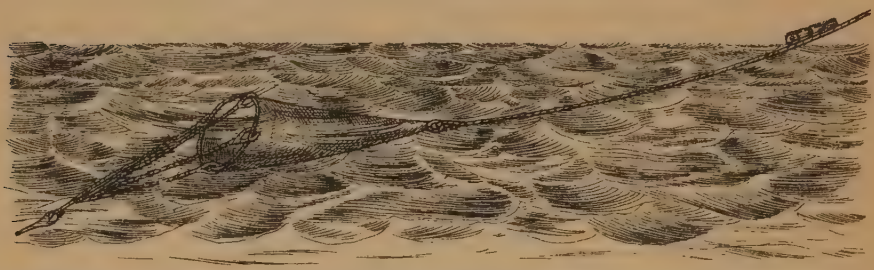
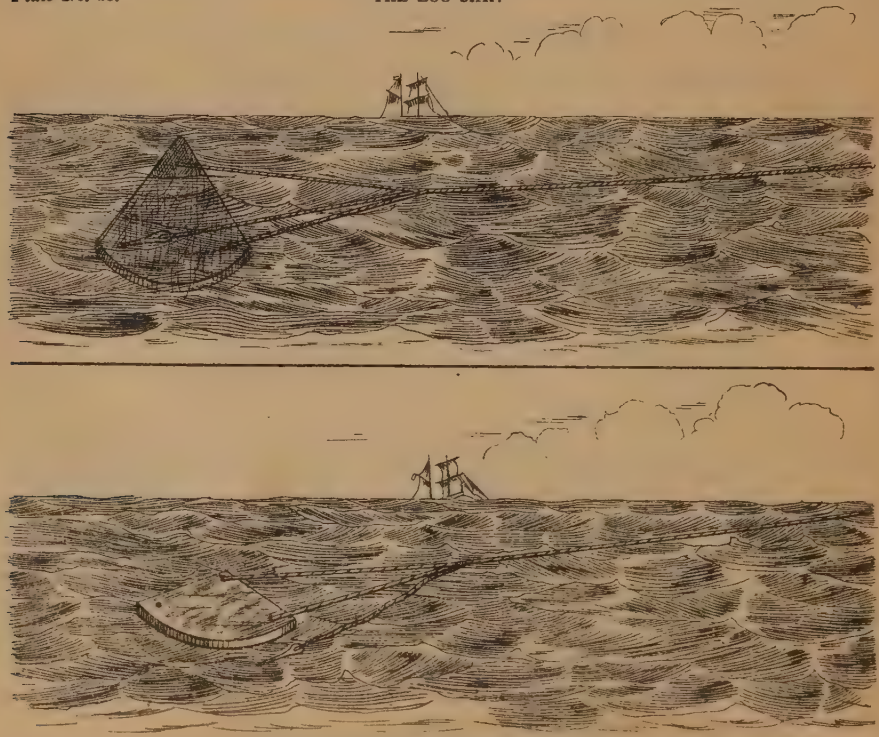


*Plate No. 28.* THE LOG SHIP.



1. The log whilst being hove—line being payed out.
2. The log being hauled in.

used the marks on the line have to be doubled. Thus if you have the 5 knot mark on the taffrail, and you are using this glass, the vessel will be going 10 knots per hour.

The log ship is constructed in two ways, so we will describe each method separately.

The LOG BAG is formed out of a piece of good canvas sewn in the form of a pyramid, about 8 inches long, and 5 inches wide at its mouth (see *Plate No. 27)*; 4 eyelets are worked at equal distances from each other round its mouth ; in each of these holes is spliced a piece of small line, about 2 feet in length, the other ends of these lines are secured to a small wood plug. A small piece of wood is hollowed out for this plug to fit into moderately tight, and seized on to the log line about 4 or 5 feet from its extreme end. A small becket is worked with the palm and needle in the apex of the log bag, and the end of the log-line is spliced into this becket.

The LOG SHIP.—Make a small teak wood quadrant about 5 inches in breadth, with one edge slightly rounded, and on the rounded edge nail on a small strip of lead ; bore a hole in each corner of the quadrant and span it with a piece of log-line *in two holes;* on the third end of the span seize on a stout piece of pump leather, rounded as a plug to fit the third hole in the quadrant, which will (when the log is to be hove) be fitted fairly tight into the aforesaid hole, and will draw out when the line is held, and allow the log ship to be hauled in with little effort. Care must be taken that the peg is fitted to go into one of the holes at the curved edge of the quadrant, but not in that hole which is uppermost when the log ship is standing vertical in the water. *(See Plate No. 28.)*

After the log-line is marked and fitted, it is wound upon a reel, carefully, so that it will run out easily and keep clear of kinks.

We will now presume you are about to heave the log. One man holds the reel above his head in both hands, standing about 15 feet from the taffrail ; another holds the glass, and sees it is all clear and ready for turning. The officer then fits the plug into the log ship or bag, hauls off a few fathoms of line from the reel, bights it up in one hand along with the log ship, and calls out, "Ready!" He then streams the log, and when the calico mark is on the taffrail he calls out, "Turn!" The seaman holding the glass turns it, and when the last grain of sand disappears, he calls out, "Stop!" The officer then holds the line, and notes the speed by the mark on the line nearest the taffrail, making due allowance if the knot is inside or outside the rail

## PATENT LOGS.

There are two or three very good patent logs in the market. It seems to be generally thought that in a strong head sea, a taffrail log shows truer results than any of the harpoon pattern; but patent logs, like any other piece of good mechanism, to give good results require to be well attended to, and carefully handled.

As regards the length of line to be used for the propeller or fan of the log, ordinary sized vessels require from 35 to 45 fathoms; larger vessels which are higher out of the water may require a little more. The lines manufactured purposely for these logs must always be used; ordinary small line, laid up in strands, will not do.

The taffrail log will not want hauling in till the end of the passage, unless it is seen by the reading on the dial that something is foul of the fan or propeller, as the dial records the distance run.

When wanting to take in the log, catch hold of the line a few feet abaft the dial and unhook it; haul away upon the line, and pass the end you have unhooked out of the other quarter, so that as you haul in on one side you pay out on the other, till you get hold of the propeller, then haul in the line at pleasure. This method prevents the line getting full of turns, and saves a world of trouble and annoyance in clearing it of kinks. Or hook the swivel into a small rope grummet, which hold in your hand, and walk the line right in along the deck, which will answer the same purpose.

The log should be oiled with clear good olive oil once every eight hours.

Patent logs generally register much truer in slow vessels than in very swift vessels, but *no log in a heavy head sea* is to be trusted to; they may act as a rough guide, but that is all. In a passage across the North Sea—in a distance of 360 miles—during the prevalence of a strong westerly gale, in coming from the Hollman towards the River Tyne, the writer has seen a good log under ordinary circumstances turn out to be 35 miles in advance of the ship when she made the English land. This will at once show what little reliance can be placed on patent logs under adverse circumstances.

At the end of a long passage, when the log is taken in, have it taken to pieces and cleaned by a competent person; then carefully oil it and put it safely away in its box. If the log is continually in use, it should, at least *once* a year, be sent to its maker to be carefully overhauled and cleaned, as he well knows its weak points, and understands

its failings much better than any one else; but see that it *goes* to the *maker*, not to the local ship-chandler. Of course all ships should have at least two of these logs on board, in case of accident to one.

The line will require regulating after you have had a run or two with a new log, either giving more length or shortening in a few fathoms, as the case may require. The ship in ballast trim may also require a couple of fathoms more line than she will when deeply laden; but no hard and fast rule can be given for this, as it is only by experiment you can come at good results as to the length of line required for each particular vessel.

The reason the taffrail log is considered superior to the harpoon log is that the latter, towing astern in a steam vessel, is subject every four hours to be working in a mass of floating ashes that are thrown overboard every watch from the stoke hole; and, no matter how well made these harpoon logs may be, some of the small ash invariably finds its way into the working parts of its mechanism, and eventually spoils it.

On long ocean passages patent logs are not necessary till nearing the end of the passage, or on making the land, but if they are used on deep sea routes they should be reset at noon each day after the ship's position has been fixed by celestial observation. (Speed and distance can never be trusted to by a *revolution counter* in a screw steamer, though very good results are obtained from them in paddle wheel steamers).

But say you prefer to use a harpoon log. Rig out a spar 15 feet outside your weather quarter, and tow the log from the end of this spar. This keeps the log out of the eddy water in the ship's wake, and also keeps it clear of the greater part of the ashes that come from the ship.

A small twigging line fast to the log line, about 20 feet abaft the spar, will enable you to haul in the log without rigging in the spar, or else make the log-line fast about 20 feet forward of the spar; and on the end of the spar lash a good sized thimble, reeve a small line through this thimble and make it fast to the log-line, so that you can haul the bight of the log-line out to the end of the spar, or slack it in at pleasure.

Never tow the harpoon log in shallow water, or it will get full of sand or dirt and be spoilt. Before putting it away after use drop it into a bucket of fresh water, and let it remain thus for a quarter of an hour; then oil it and stow it carefully away. When hauling it in the

log must not be allowed to touch the vessel's side; great vigilance in this respect *must always be used*, or the fans will be bent and the log thus made useless.

But as to patent logs in general, it may be remarked that to obtain *good* results *great care* must be taken of them. A taffrail log catches a lot of grit from the funnel if Welsh coal is used; and, as before remarked, a harpoon log is always liable to pick up grit when the ashes are hove overboard. Constant care and oiling are the only means by which they can be kept at all reliable.

It must also be remembered that in tideless waters a well cared for taffrail log will generally register a little more than the actual distance run by the vessel.

Intelligent care will make a patent log a most valuable help to navigation; careless, rough usage will turn it into a useless appendage. In this as in other ways the careful seaman who uses the means at his disposal with intelligence, and is particular in seemingly small details, will have a good chance of running clear of accidents during his sea career.

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## SECTION VII.

## THE ACTION OF THE WHEEL ON THE RUDDER.

*(See Plate No. 29.)*

This is rather confusing for the novice to understand; indeed men who have been some time at sea are apt to make mistakes in this matter; and it is never safe to give a helmsman an order "Starboard!" or "Port!" to avoid a vessel, without attending carefully to see that he puts the wheel the right way.

There is apparently a contradiction of terms, and it seems as though an order to 'Port' ought by right to send the vessel's *head* to 'Port'; but it must be remembered that the *full* order would be "Port the *Helm*." Now the helm, or tiller, is the handle shipped into the rudder head, which directs the rudder. When this *helm* is put over to the port side of the vessel the rudder itself goes over to starboard, and the vessel's head also moves in the same direction, namely, to starboard.*

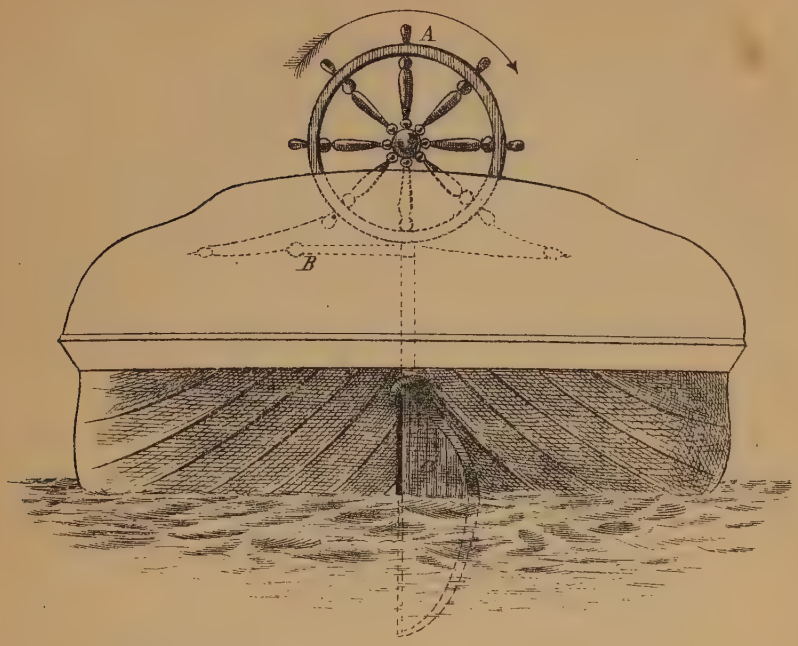
By general use and custom the wheel ropes are led in such a manner

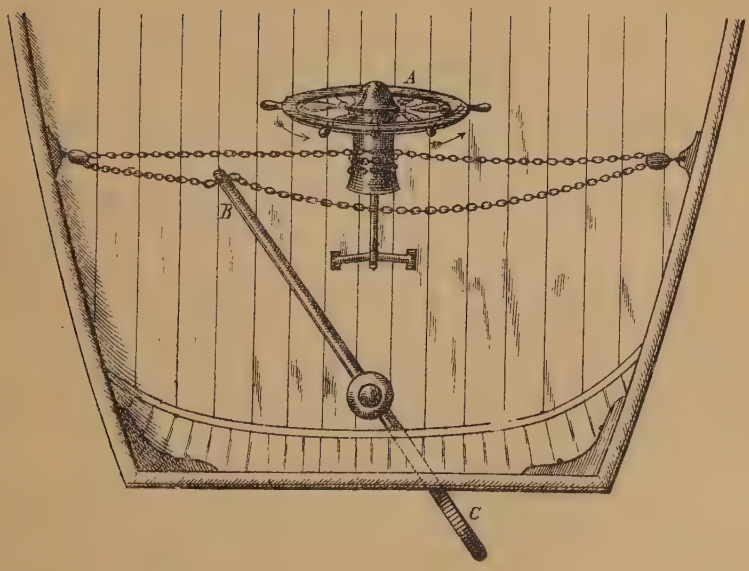
* In most large vessels of the present day the tiller ships *aft*, and will thus go the same side as the rudder; but these terms date back to the time (not so very long ago) when all tillers shipped forward.

*Plate No. 29.*

## THE ACTION OF THE WHEEL ON THE HELM AND RUDDER.

**Ship's head, rudder, and wheel move to one side of vessel, helm moves the opposite side.**




*A.* The wheel, moving in the direction of the arrows, moves
*B.* The helm or tiller to *port*, and
*C.* The rudder to starboard. The ship's head will go to starboard.

that to port the helm the wheel must be pulled over towards the starboard side, or the same way that the vessel's head will move.

The use of the terms, "Port" and "Starboard the Helm," are seamanlike and proper. Whether it would be judicious to have wheel ropes led, or steering machinery so fitted that the direction of the wheel should be altered, as has been sometimes suggested, is another matter. In the vessels of some foreign nations this is actually the custom, which it may be well to bear in mind in dealing with foreigners, as in these nationalities "Port" would answer to our "Starboard."

The effect of the helm on the ship's head may be briefly stated thus:—

WHEN THE VESSEL HAS HEADWAY.

Port Helm—Head goes to Starboard.

Starboard Helm—Head goes to Port.

That is, with headway her head goes the opposite way to which the helm is put.

WHEN THE VESSEL HAS STERNWAY.

Port Helm—Head goes to Port.

Starboard Helm—Head goes to Starboard.

That is, with sternway her head goes the same way as the helm is put.*

The effect of a screw propeller alone on the ship's head is—

RIGHT HAND SCREW.

Engines going ahead—Head goes to Port.

Engines going astern—Head goes to Starboard.

With a left handed screw the opposite to this will take place.†

Steering is one of the things which is required of an Able Seaman. In ordinary circumstances this is soon picked up by a painstaking youth; in fact, green hands often make better steersmen after an hour or two's practice than a careless old sailor. Steering a vessel when running heavy is a more serious matter, and one which ought not to be entrusted to any but a good seaman.

Two principal things to remember in steering are—to use as little helm as possible, and to steer by the ship's head, not the compass.

* The question of whether the rudder moves the head or the stern is still a matter of question, and need not be entered on, except to say that suddenly putting the helm over at full speed the ship's stern will move far quicker than her head; and this should be borne in mind, as the application of this knowledge may in some cases avert a collision.

† The propeller (like the rudder) has most effect on the stern, which is the end of the ship that moves. The above results cannot always be relied on, as, for instance, a vessel going fast through the water, if her engines are reversed, may not feel the expected effect of the screw.

On joining a new vessel it is always worth while trying how she moves with helm each way engines going ahead and astern from dead stopped, and the same from full speed.

This last remark will appear strange to the young student coming fresh to the subject: the following remarks will explain the matter.

If more helm is used than is absolutely necessary it will cause the vessel to yaw about from one side of her course to the other; whereas by watching the ship's head, or the weather leaches of the sails, against the clouds by day, or the stars by night (keeping an eye on the compass also) a *little* helm given *quickly*, in response to the *first* sign of movement of the ship, will have much greater effect in keeping her steady on her course than waiting till she begins to swing off and *then* giving her a lot of helm to stop her. If the steersman waits till the *compass* moves in answer to the ship's head, before he gives her helm, it will be too late; for the most sensitive compass will not answer to the movement of the ship's head sufficiently quick for the purpose of steering. Running heavy on a dark night the compass is the only *visible* guide, but a good steersman *feels* when the ship wants helm in *such* cases. This more especially refers to steering with the wind free.

When steering full and by, a well appointed ship should carry a steady weather helm, that is, she will go along straight, with perhaps half a turn of the wheel 'up.' In this case the weather clew of one of the upper sails, say the main royal, should be kept just 'touching,' or with the wind making the weather clew to shiver the least bit; this will tell the helmsman that the ship is 'to the wind.'

When close hauled, if there is a heavy head (or bow) sea, it is correct to ease the helm a few spokes at the beginning of a heavy dive, putting it up again when the ship begins to recover herself. Steering full and by, it is not, strictly, the helmsman's duty to pay much attention to the compass; the officer of the watch should, by rights, be responsible for knowing what course the vessel is making. Steering with the wind free, on the other hand, the helmsman has a good course given him, and is responsible that the ship makes that course.

When relieving the wheel the steersman gives the course or order to his relief, who should *answer back* the same words to shew that he has heard rightly. Thus, when by the wind, the man giving up the wheel says "full and by," the man relieving repeats "full and by," and thus shews he knows what to do. In the same way the course, when steering one, should be repeated, and the man leaving the wheel should listen and be sure his relief answers correctly; but in both these cases it is the duty of the officer of the watch to hear the relief given, and make sure that the new helmsman has the right course.

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DURE'S PATENT RUDDER.—This new invention will, if brought into use, improve the steering of vessels very greatly. The principle of it is that the rudder blade increases in thickness towards *the after edge, which is the broadest part.* Owing to this simple improvement the rudder travels over an arc 15° less than the ordinary rudder, and acts much quicker in response to the

Steering a steamer is a much simpler business; but in smartly navigated vessels the course is given in degrees instead of points, and accurate steering is expected.

In moderately smooth water a well trimmed steamer should go along on a nearly steady helm, when the exact amount of helm she requires has been found by experience. In a vessel that will steer in this way it is a good plan to have a mark on the wheel chain, in sight of the helmsman, so that having 'ported or 'starboarded' for a vessel he may be able at once to right the helm again to the exact point at which she will go along steady; the mark will require lighting by a bull's-eye lantern at night. This method saves much bad steering, and the ship makes more reliable courses, which, in narrow waters, is a matter of great importance.

In a sailing ship "weather-helm" means when the *rudder* goes over to the lee side to keep the ship's head from coming up into the wind. A well appointed sailing ship should always carry a little weather-helm when on a wind. When going with the wind free, if she comes to windward she is said to "gripe," and she then wants weather-helm to send her back to her course, but will not *carry* weather helm—that is, require it *all* the time—as she does when "close hauled."

In tacking, "helm's-a-lee" is the order called out when the helm is put to leeward, causing the rudder to move to windward and bringing the vessel's head to the wind.

In screw steamers the propeller has considerable influence on the steerage, and a knowledge of this can, in still water, be used to turn a steamer in a very small space. For instance, port the helm and start ahead. The screw forces the water sternward and gives the rudder steerage power before the ship moves appreciably. As soon as headway becomes *just sensible*, reverse the engines, starboard the helm; the screw water then presses on the aft side of the rudder, and quickens the movement of her head to starboard. By attention to these points a screw steamer may be turned in a very small space, though it might take some time longer than turning under way. But every vessel must not be expected to answer in the same way, and a strange vessel should be tried.

If a steamer's engines are suddenly reversed to avoid collision, *the action of the helm* (not the *screw*) whilst headway remains, cannot in a ship strange to you be depended upon, and she *may* steer as if going astern through the water.

Some years ago a Committee of the British Association inquired into these matters, the result of their experiments seeming to prove that an

movement of the tiller or the steering wheel. It also entirely does away with rudder vibration It has already been tried in several vessels, and the results are highly satisfactory. The patentee's address is 233 Holton Road, Barry, near Cardiff.

ordinary steamer will come to a standstill from full speed by reversing the engines in from four to six times her length. Whilst reversing, the rudder produces none of its usual effects to turn the ship, but, *such as it is*, its effect is to turn the ship in the opposite direction from that in which she would turn if the screw were going ahead; but this effect is not much in any case. The influence of the rudder being feeble, the vessel is at the mercy of any other influences that may act upon her, as wind or tide. Thus the wind may slew her in the very direction which is not desired. As her headway diminishes, the screw will begin to act on her head, and turn her to starboard or port according as the propeller is a right or left-hand one. Most steamers' heads would thus be inclined to go to starboard, but it requires acquaintance with any particular vessel, laden and light, to be able to tell how she will act going astern. These remarks are given on the authority of the report of the Association referred to; they will perhaps scarcely recommend themselves to the actual practical experience of most shipmasters, but will serve as a warning not to trust to the action of a strange ship till you have tried her and know what she will do. Of course it will at once be seen that in a tide-way or strong wind other forces are at work which might cause a variation in the effects mentioned above; and it must also be remembered that the way one ship will act under helm is no guide for another ship.

Steam steering-gear is in these days becoming almost universal in steamers, and is a most important factor for safety, especially in crowded waters. This gear should be amidships for choice, it is then directly under the control of the officer of the watch, who can see if anything goes wrong with it. There are so many different patterns that it is impossible to go into their merits and demerits, but a steering-gear should fulfil the following conditions, viz.:—That under all circumstances, *especially when the vessel is full speed*, the gear should be fully under control of the helmsman, and should be so arranged that it can be put hard over in a reasonably quick time without jamming itself. It is also proper that the steam pipes should be exclusively for the steering gear, and so arranged that water cannot lodge in them, and both steam and exhaust pipes should be of the same internal diameter as the steam and exhaust connections to the cylinders.*

When steering machinery is aft, it is in the first place away out of sight, and sometimes, in very heavy weather, out of reach; a great

* With steam steering-gear which exhausts into the condenser, *beware when going slow!* In canal and river navigation provision should be made for exhausting into the open air, and always used. If not, the gear may refuse duty and stick at a critical moment. Many cases of stranding have occurred through this simple cause.

amount of shafting and a number of cog-wheel connections are required, which, unless led very true, make steering difficult. But perhaps the worst feature is that the drift of wheel chains is so short that metal springs *have* to be resorted to, to ease the heavy "jumps" on the rudder in a high sea, and it is to be feared that, though this plan is used in many large Atlantic steamers, the extreme rigidity gained by having the steam-gear close to the rudder may have been the cause of some of the accidents to rudders in late years. With the gear amidships the necessary length of rods and chains is sufficient to give the rudder enough play, and with such an arrangement it is always some of the connections that will carry away, and not the rudder head.

Wheel chains should often be examined, also the pins of the gins (especially with steam gear). Chains of all kinds should occasionally go ashore and be put through the fire; unless this is done they become brittle and untrustworthy.

There are several methods of fitting reserve steering-gear, the most usual of which is the screw gear which is secured directly on to the rudder-head by a cross-head, and connects with the after-wheel. The pins and worms of this should be carefully looked after and kept free from rust. When polished bright they should, before going to sea, have a coat of white lead and tallow, such as engineers use for the bright parts of their cylinder tops; this will preserve them from rust by salt water, and will in no way hinder their instant use when required.

Another method of fitting reserve gear is shown in *Plate No. 30.* Here, instead of a cross-head, as is the usual method with screw gear, a spare tiller *A* can be lowered down by the screw on the rudder-head till it takes the clutch at *C*. This method necessitates two sets of wheel chains leading to two different wheels.

In heavy weather relieving tackles set up and rove as an endless fall are of great service in easing the strain on all gear. *(Plate 30a.)* This fall should be made of hide rope, and the blocks should be thoroughly well made, and of extra strength. The plate shews a fall rove as gun-tackle purchase; for heavy vessels a greater purchase would be better. This can be used perfectly well with steam gear, and should a wheel chain part, the rudder is still under control; it is a matter for wonder that these tackles are not more universally used.

DESCRIPTION OF PLATE NO. 30*a*.

The standing part is made fast at *A*, the tackle is then rove off and set up *as taut as possible* by a watch tackle on the end *B*, which is then made fast. A tackle rove of new rope will require setting up again in a short time if there is much sea on. Hide rope is the best for this purpose: wire would do if it could be set up taut enough.

With the annual increase in the size of steamships, it naturally follows that the tillers on the rudder heads must also increase in size and strength. To continue their construction as shown on *Plates No. 30 and 30a*, would mean that so large and heavy would they become that considerable strain would be thrown on both rudder head and tiller arm to keep the latter in a horizontal position.

In large steamers, therefore, the iron bar type of tiller is replaced by a plate quadrant, so named on account of it being the one-fourth of a circle.

The after-part, or arc of the quadrant, rests on rollers which travel in a bed, so relieving the rudder head of the strain as well as being conducive to steady movement (see *Plate 30b*).

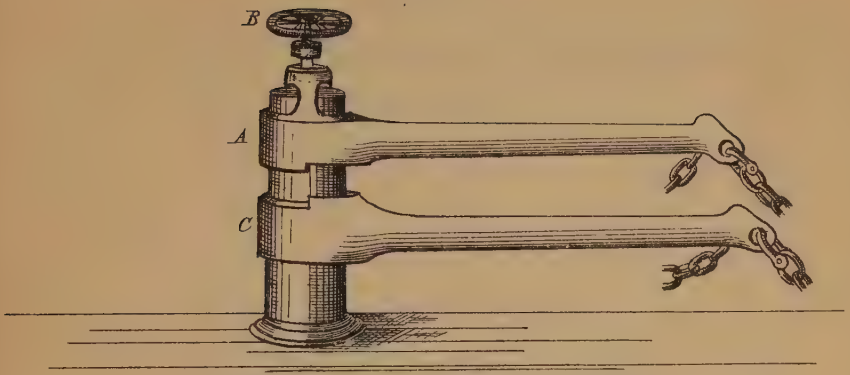
The rudder chains are fixed so as to give additional strength, and in that way the chain trending aft on the starboard side of the ship leads round the quadrant, in a channel made for the purpose, and secured to the port side of the quadrant. The chain on the port side naturally leads the reverse way, so that when the pull of altering helm is put on either side the strain is not exerted on one corner of the quadrant, but the whole arc is more or less gripped and shares the burden.

The greatest angle to which a rudder is allowed to form with the fore and aft line of the ship is 40°, and to prevent any excess of this, buffers are secured on the deck in such a manner that the quadrant comes into contact with them when the limit is reached on either side.

The action of a good steam steering gear is quick and immediate but it means that a sudden tension would be put upon the wheel chains A rough sea, too, acting upon the rudders causes it to give a sharp kicking movement, which no tackle, as shown in *plate 30a*, would entirely free the chain from receiving, so these shocks are transferred to springs fitted at convenient positions along the chains (*Plate 30b, fig. 2*). There is, however, one shock absorber between the rudder and the wheel chains, and that is known as the Stuffing-Box. This Stuffing-Box is situated in the deck where the rudder head comes through.

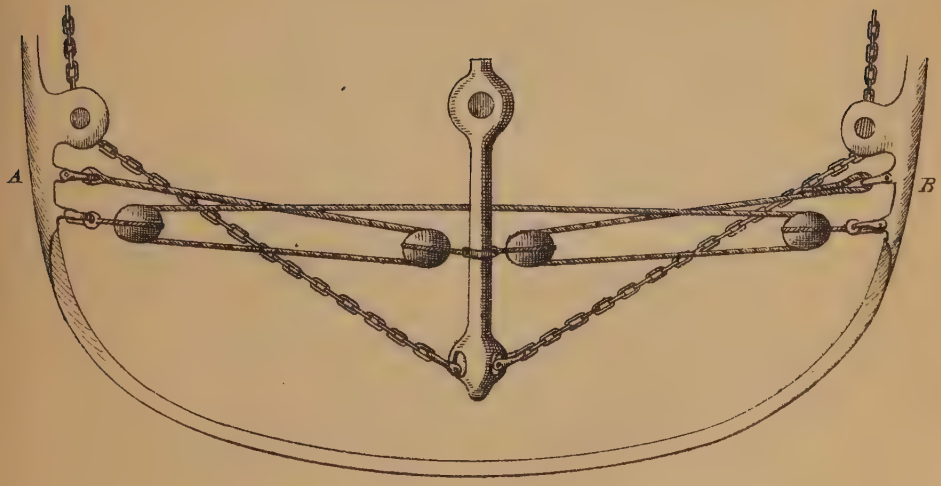
Collars made of wood—lignum vitæ—are fitted in such a way that they may be tightened up by wedges or screw gear, and grip the rudder head So effective is this process that if they are too tight it materially affects the steering when hand power only is used. Between the hard wood and iron rudder-head, packing is inserted so that the friction is not too drastic.

*Plate No. 30.*




Method of connecting reserve steering gear. The upper tiller *A* works up and down on the rudder head by the screw *B*, and when required is screwed down and ships into clutch on the main tiller *C*.

*Plate No. 30a.*




Endless fall relieving tackle, sometimes called a "kicking tackle."

*A*. Standing part; tackle is set up on the end *B*, which is then made fast.

*Plate 30b.*

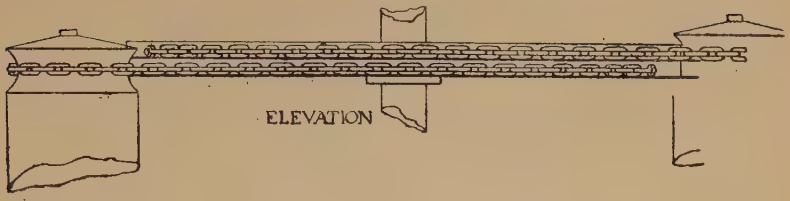



FIG. 1.

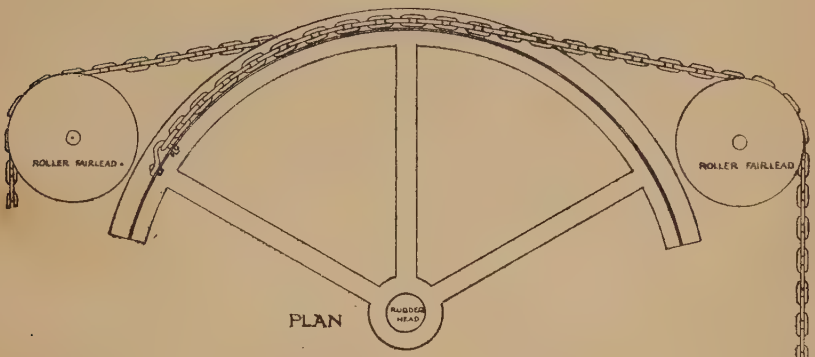
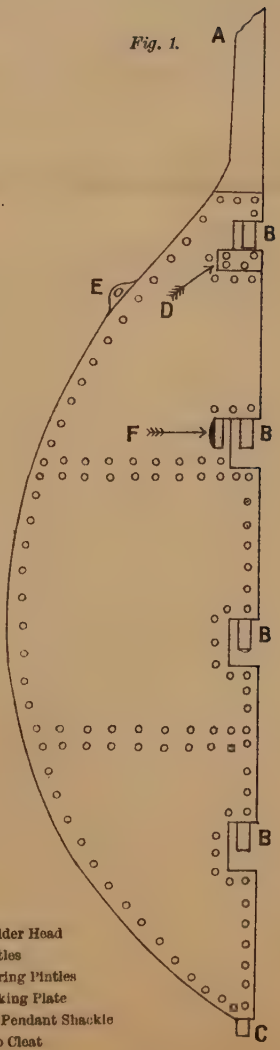



FIG. 2.

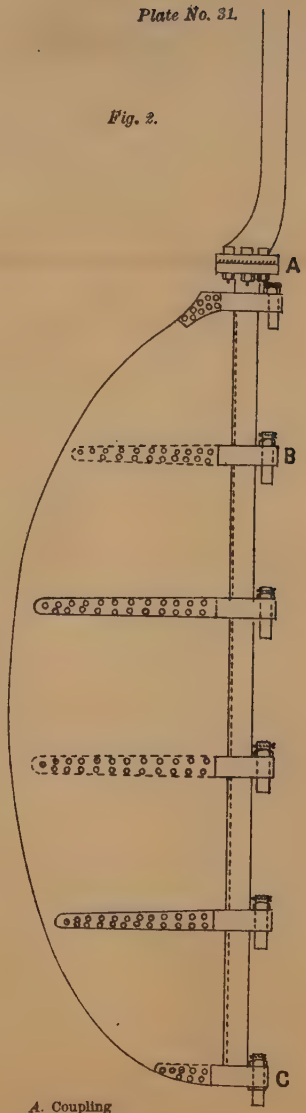
*Plate No. 31.*

*Fig. 1.*




*A.* Rudder Head
*B.* Pintles
*C.* Bearing Pintles
*D.* Locking Plate
*E.* For Pendant Shackle
*F.* Stop Cleat

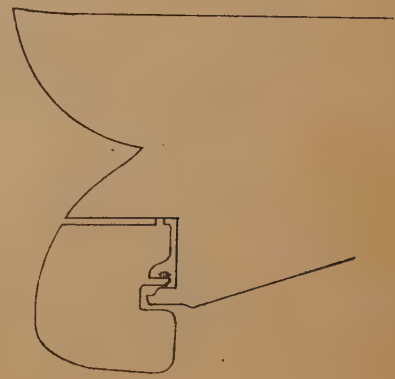
*Fig. 2.*




*A.* Coupling
*B* Locking Pintle
*C.* Bearing Pintle

*Fig. 3.*

BALANCED RUDDERS



## RUDDERS

The rudder being an important adjunct to a ship it is therefore necessary that it should be strong and durable.

In vessels built of iron or steel there are three types in general use.

1. Plated Rudder (see *Plate 31. Fig. 1*).
2. Single Plate Rudder „ „ „ *2*).
3. Balanced Rudder „ „ „ *3*).

The Plated Rudder is constructed, as its name applies, viz., a wrought iron or cast steel frame which is plated on each side, the hollow part being filled with wood so that in case of leakage it would not get filled with water, although at the bottom there is often to be found an iron screw plug that can be taken out when the vessel is in dry dock to allow any accumulation of water to drain away.

This type of rudder is, however, rapidly giving way to type 2.

Single Plate Rudder, consisting of a single plate having arms rivetted to it on each side alternately, port and starboard, and about 4 to 5 feet apart.

The plate itself varies from $\frac{3}{4}$ to a little over 1 inch in thickness, according to the size of the vessel; and the rudder head itself from 3 to 11 inches, relative to the above conditions.

The main part is grooved in such a manner that the plate can be inserted in the groove, and the arms shrunk on and keyed to it.

Balanced Rudder, a type generally used in shallow draught vessels, and much more common in the Royal Navy than in the Mercantile Marine.

It gives a greater water surface with a smaller vertical depth as compared with the other two mentioned, having a part of its effective area on the fore part of a vertical line drawn through the rudder head and heel plate.

In the first type it will be seen by the illustration that the rudder is hung by means of gudgeons and pintles on the rudder post and rudder respectively, although the main support is the heel plate projecting from the keel of the vessel, and on which the bearing pintle marked *C* is resting.

Each of these terms used are marked in the illustration, so there ought to be no difficulty in the reader following them.

At the top pintle is a bracket, known as the locking plate, bolted

to the rudder to prevent it becoming unshipped, a circumstance so very common in small boats.

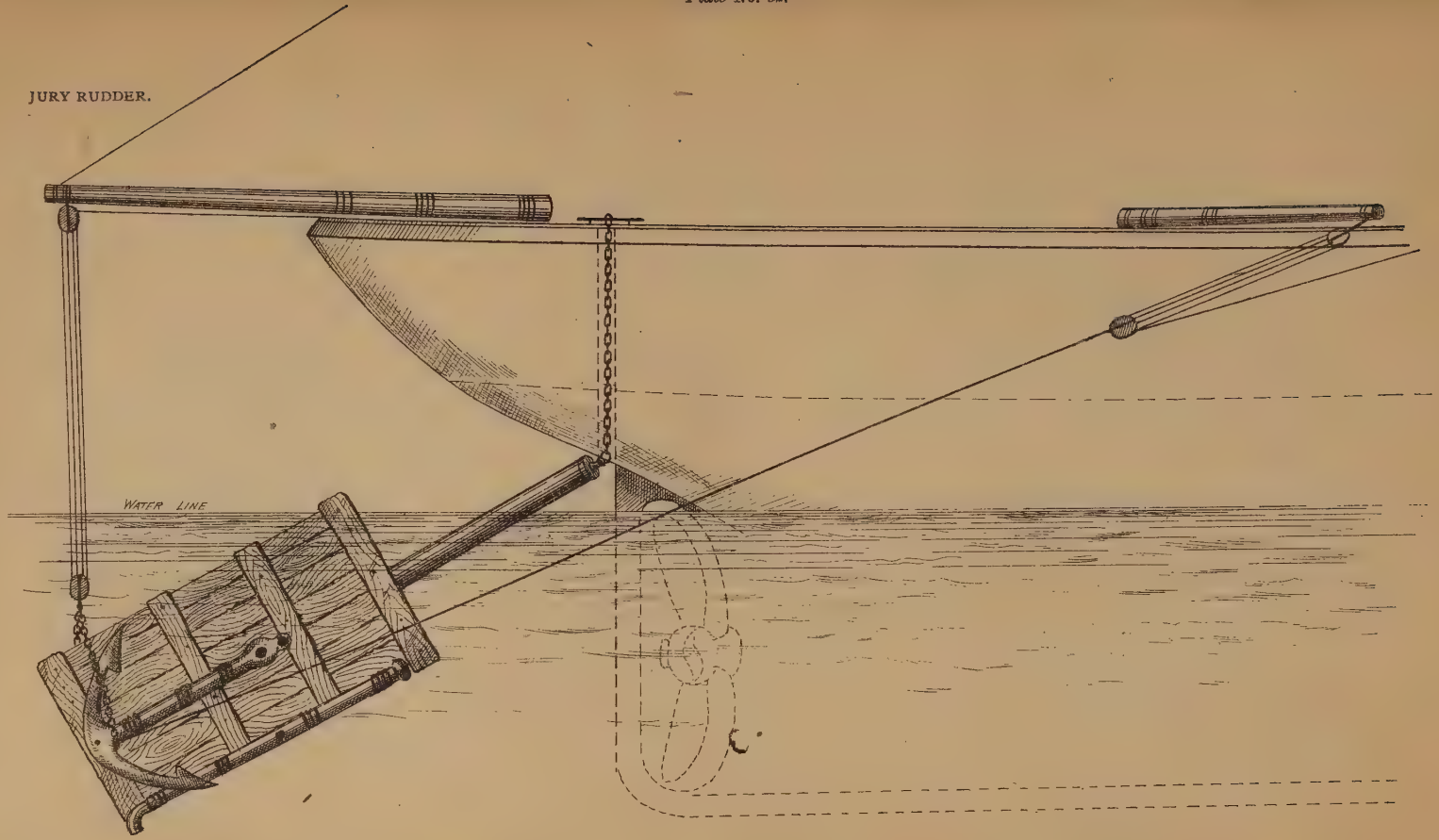
Comparing those illustrated by fig. 1 and fig. 2, it will be noticed that the rudder in fig. 1 has a continuous rudder head which runs up through the rudder trunk, and so in one piece to the quadrant or tiller, whereas in fig. 2 there is a joint made by two flanges bolted together.

Now in the former case when it is necessary to unship the rudder entirely, the vessel must be so placed when in a dry dock that the rudder post is directly over the rudder pit (a cavity in the bed of the dry dock, dug out for the purpose), so that after lifting the rudder clear of the heel plate and gudgeons it may have room to be lowered and hauled out clear until the rudder head can be free from the rudder trunk. It also necessitates having a rudder trunk of a greater diameter than that which might be used for that of fig. 2, for whereas in the former there must be room to manœuvre the rudder to get it clear, in the latter case it would only be necessary to unbolt the flanges and then lift the shaft just sufficiently to leave room for the rudder itself to be hoisted clear of the heel plate, although even this is not necessary in the majority of cases.

To prevent any volume of water being washed up the rudder trunk, a tail-plate is bolted to the plating of the ship under the counter and where the rudder head enters the rudder trunk.

The stop cleat is marked in the illustrations, but the buffers on the deck, as mentioned previously, are much more effective.

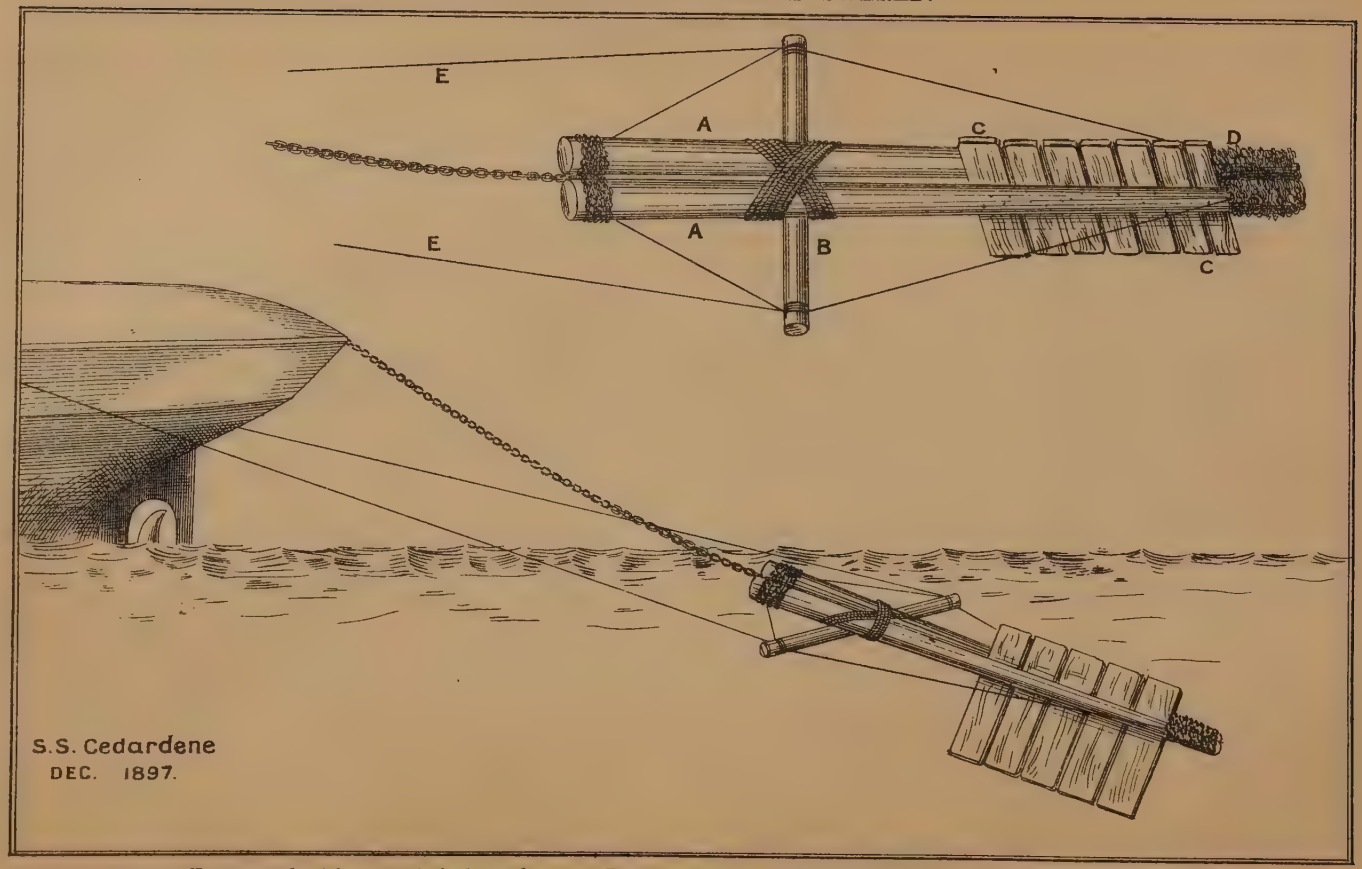
JURY RUDDER.




The machine may be tried lowered further down, and will probably do better so. It must be well weighted at the lower edges, and slung by the tackle fair up and down.

*Plate 32a.*

## A JURY RUDDER WHICH ANSWERED.




*A A.* Two cargo derricks, cross-lashed together. *B.* Cross spar for steering lines. *C C.* Planks forming rudder-blade.
*D.* Chain to weight and immerse rudder. *E E.* Steering lines.

The captain told me that this machine answered well. When either of the steering lines was hove on, the rudder sheered right over to the same quarter.

## JURY RUDDERS.

In the days of the short wooden sailing ship, considerable success was generally the result of rigging a jury rudder in cases when rudder-head or rudder had been disabled or lost at sea, and several methods have appeared from time to time in different works treating on seamanship. But in these days of steamers and of long heavy sailing ships it is a matter of great difficulty to construct any machine which shall really steer the vessel.*

Some steamers have been steered easily with appliances which, when tried on others, have signally failed.

On one occasion a steamer in the China trade, after losing rudder and after-post, steered some 700 miles with the main trysail boom slightly weighted at the end. This method has been tried in other cases and found completely valueless.

On an Atlantic steamer of the smaller class, an engineer rigged a jury rudder, after (in his own words) "the deck hands had tried all manners of contrivances and failed," which brought the vessel safely to her destination without much trouble. This machine, a sketch of which was given the honour of a place in an engineering paper, was nothing but a trysail boom, with two large bulkhead doors bolted together and secured to the end of it, the top end working from the taffrail. This method has been tried in other steamers and signally failed.

A sketch is here given of a rudder which was successful in accomplishing its purpose; it will be noticed that it is of good size, and that the upper end of the spar being hung to the lower end of the rudder trunk (the broken rudder-head having been drawn) instead of up on the taffrail, the blade has much better hold of the water.

### Description of Plate No. 32.

The upper end of the boom is hung by a stout chain rove through the rudder trunk, and secured to a strong bolt laid across the deck (the broken part of rudder head having been drawn out). Care must be taken that the outriggers for steering chains are far enough forward, and that the chains are led clear of the propeller. All the gear should be extra strong. If the lower block of the tackle is close down to the rudder, it can be hove up out of harm's way if required.

It would appear that the principal cause of failure in late attempts to steer with jury rudders lies in the fact that the large size of the

* For vessels of this kind it is not worth while to mention the method of steering by a paid out hawser, or a stern boat lowered down, such as appear in old works on seamanship, and are copied again and again into other publications. They would be utterly useless applied to such vessels.

vessel has not been properly considered, and the machine constructed has not been large enough for its work. But it is a question whether, in a steamer, it is not better to steer her with a drogue on each bow, fast at the end of a scope of wire hawser, which can be lifted and lowered as required. A steamer which lost her rudder in the Atlantic some years ago, made two attempts to steer with jury rudders such as have been just described, but being unsuccessful this method of drags was tried, with the result that, in moderate weather and with the wind not too far abeam, a successful result was obtained, and the vessel was steered some hundreds of miles in this way. The sketch here given is of a similar contrivance.

DESCRIPTION OF PLATES NOS. 33 AND 34.

30.—This shews method of steering by a drag from the bows. The hawser is led out of the bow chock and securely fastened to the drag *A*, which must be made extra strong; this is slung fair up and down, and hangs by chain *B* to the outrigger, being hoisted and lowered as required by the tackle and pennant *C*, which leads to the winch.

31.—Shews the vessel bows on, and the drags on both sides, the starboard drag *A* being *in the water*, and the port one *B* being lifted out; the ship's head will be checked round to starboard, this being equivalent to porting the helm.

NOTE.—Though the outrigger is far aft as possible, it can be supported by a topping lift from the foremast. The gear could be rigged from the mainmast if thought advisable to give the spring more length.

If taking assistance from another steamer, it has been found best to let the disabled vessel take the other in tow; by this means she keeps steadier, and is steered easily by the other ship.

A rudder is usually carried away in heavy weather. Whenever this accident happens, in sail or steam, the very first thing is to get the vessel hove-to. If in a deep laden steamer this is a matter of the utmost moment, and no time should be lost in getting out a sea anchor; and if there be no time to do this, the best thing is to unshackle a bower cable and pay out 60 fathoms or so; it is probable that this will bring the vessel head on, when she may be allowed to drift, nursing her as required with the engines. Having got the ship in a safe position, take time and rig a strong and large machine before trying to steer. If the work is hurried, and a small second-rate affair is rigged up, no success can be expected. A rudder that takes a couple of days to make will, if it answer, soon make up for lost time.

Do not attempt to steer with a jury rudder except in fairly moderate weather: if a gale comes on, out with the sea anchor, and wait till it is over.

*Plate No. 33.*

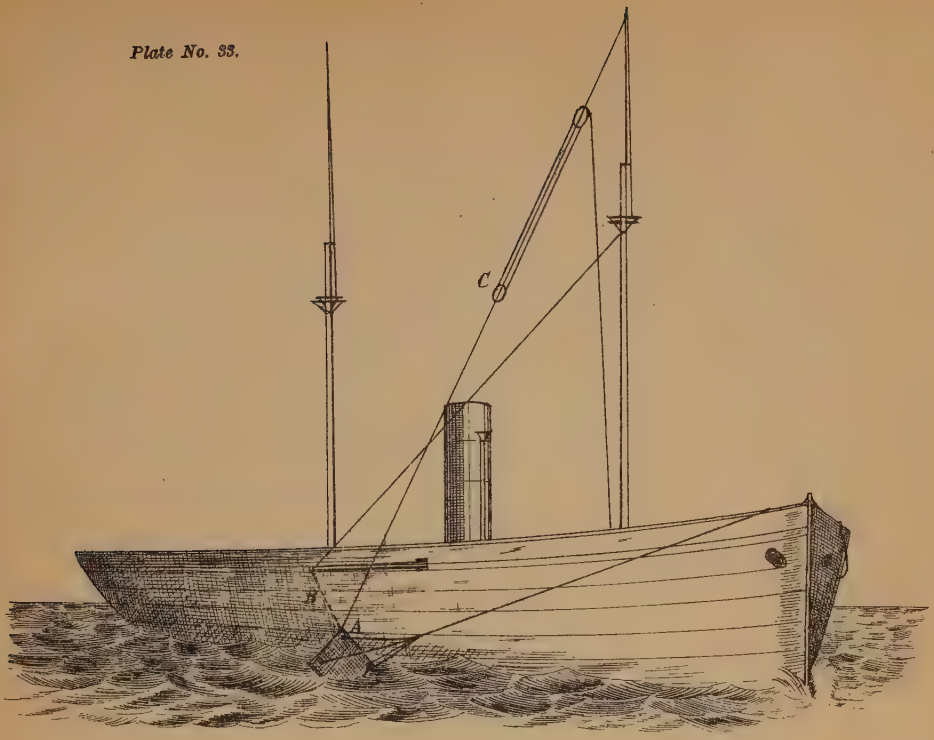



*Plate No. 34.*

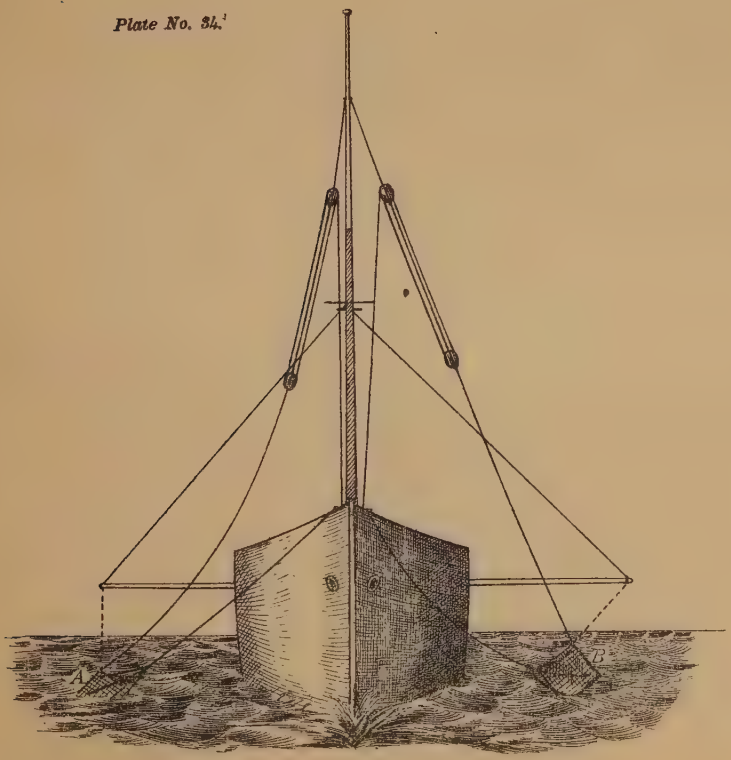
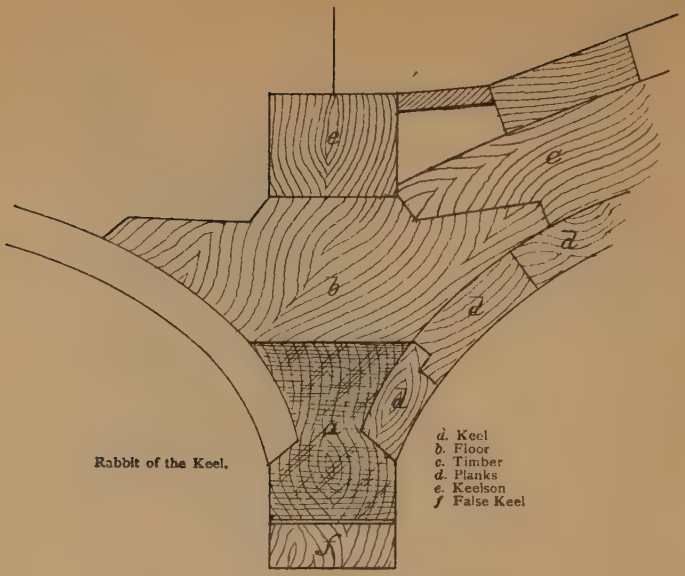


*Plate No. 35.*

PRINCIPAL TIMBERS OF A WOODEN VESSEL,

1. Cutwater
2. Gripe
3. Keel
4. Stem
5. Apron or stomach piece
6. Stemson
7. Fore deadwood
8. Keelson
9. After deadwood
10. Sternson
11. Inner sternpost
12. Sternpost
13. Floors (the whole line along)
14. Knight-heads
15. Pawl-bitt
16. Stern timber
17. Transomes

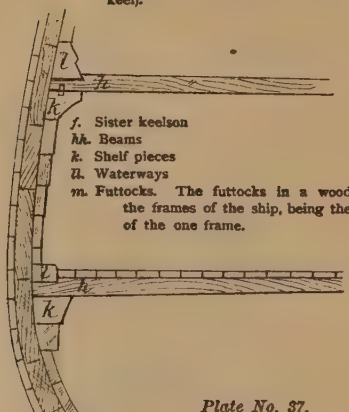
*Plate No. 36.*




SECTIONS OF THE LOWER FASTENINGS OF A WOODEN VESSEL.

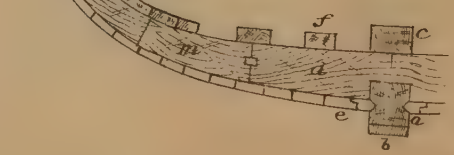
SECTION OF WOODEN VESSEL.

*a.* Keel
*b.* False keel
*c.* Keelson
*d.* Floor
*e.* Garboard strakes, rabbeted into the keel (in an iron vessel these are bent over and rivetted to the keel).



*f.* Sister keelson
*hh.* Beams
*k.* Shelf pieces
*l.* Waterways
*m.* Futtocks. The futtocks in a wood ship make up the frames of the ship, being the separate pieces of the one frame.

*Plate No. 37.*



## SECTION VIII.

## THE HULL, (WOOD.)

The most important parts of a vessel's hull are:—Stem, Keel, Stern-post, Floors, and Timbers (called Frames in an iron ship).

*Plate No. 35* shews the principal timbers of a wood vessel.

The stem, stern post and keel, being all fastened together, form the backbone of the vessel. These have inside pieces strengthening them.

The stem has apron and stemson.

The keel, the keelson and sister keelsons.

The stern, the inner post and sternson.

On this backbone is raised the hull of the vessel.

First, between the keel and keelson, the floors and timbers or frames start; these form the ribs of the hull.

From stem and stern, breast-hooks, crutches, transoms, and dead-wood give internal strength; whilst in the main body, beams, stringers waterways, and inter-costal keelsons, &c., bind all together.

On this solid frame-work is fastened the outer planking or plates.

The stem has a groove or rabbet worked into it to receive the fore ends of the outer planking (termed the fore hoods). The stem is in fact the forward continuation of the keel. The bows are further strengthened inside by iron frames fitted to the shape called breast-hooks.

The stern is the after continuation of the keel. Like the stem, it has a rabbet for the reception of the *after* hoods.

The stern is internally strengthened, like the bows, by iron frames termed crutches, and by strong timbers called transoms.

The keel, and method of securing the garboard strakes to it, is shewn in *Plate No. 36.* In the case of the wood ship it will be seen that the planks are fitted into a rabbet, as at stem and stern; whilst the iron vessel's plates overlap and rivet to the keel in the same way that her bow and stern plates are rivetted to stem and stern post.

The Floors are bolted to the keel, and, with the keelson, form as it were one solid block.

The timbers are built up in pieces called futtocks, rising from the floors *(Plate No. 37).*

## SECTION VIII*a*.

## THE HULL, (IRON OR STEEL).

This section deals with the general construction of an iron or steel sailing ship so far as the hull is concerned. In a later section that of steamers is dealt with, but in the majority of cases herein mentioned the following remarks will apply to both.

It is not the intention of the writer to endeavour to dip deeply into naval architecture, for that in itself is a broad study engaging the attention of some of the best brains in the country.

We merely intend to give the reader a general knowledge of how a ship is constructed and the names of the principle parts that together form the body or hull, for there are still many young officers serving in the Mercantile Marine who are not yet quite sure as to the difference between a "stringer" and a "cargo batten." For more advanced knowledge and for examination purposes the Board of Trade recommend "*The Modern Practice of Shipbuilding in Iron and Steel*" by S. Thearle.

To be classed at Lloyd's, all material used in the construction of a ship must pass the requirements of the Committee of Lloyd's Register, and all steel worked into the ship must be tested at the steel works by their Surveyors, and when found satisfactory it is stamped with a brand thus ℟

As in the case of wooden vessels, the most important parts of a vessel's hull are;—Stem, Keel, Sternpost, Floors, Frames, Beams, and last, but by no means least, the Shell Plating.

Referring to *Plate No. 39*, these and many more component parts are shewn; all having their functions in the strength and rigidity of the hull.

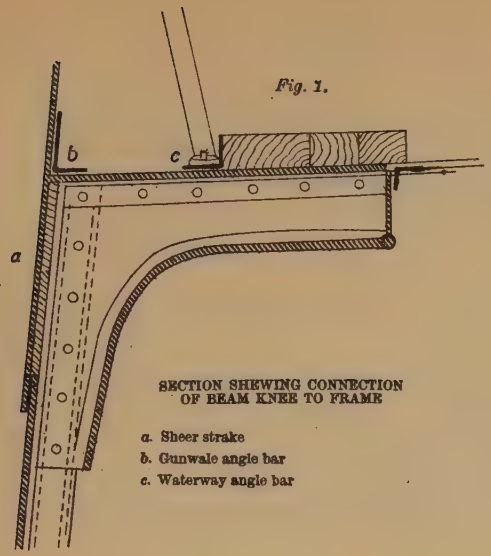
The general regulation and graduation of scantlings suitable in the construction of a vessel are not left to any hap-hazard methods, but are governed by rules, and as the size of a vessel, even to a most casual observer, is reckoned by her length, breadth and depth, these considerations or arguments enter into the calculations.

For such purposes the "LENGTH" is measured from the after part of the stern to the fore part of the sternpost reckoned on a line with the upper deck beams.

The "BREADTH" to be the greatest moulded breadth of the vessel.

The "DEPTH" to be measured as from the top of the keel to the top

*Fig. 1.*




SECTION SHEWING CONNECTION OF BEAM KNEE TO FRAME

*a.* Sheer strake
*b.* Gunwale angle bar
*c.* Waterway angle bar

*Fig. 2.*

PLAN OF UPPER DECK STRINGER PLATE

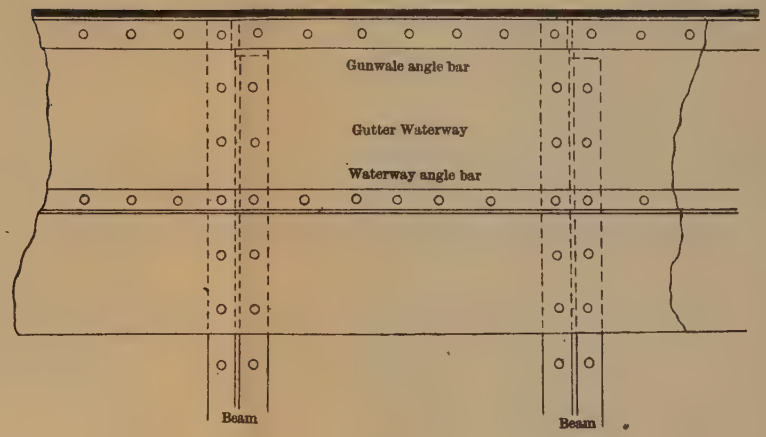
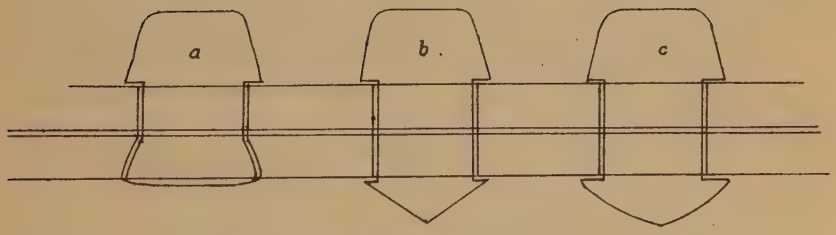
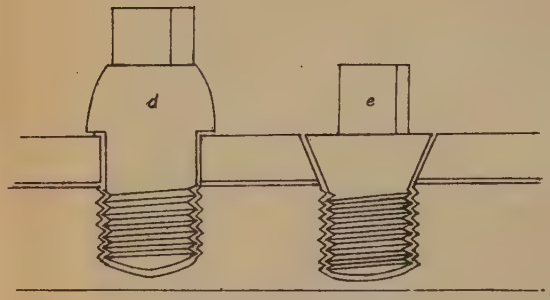



*Fig. 3.*

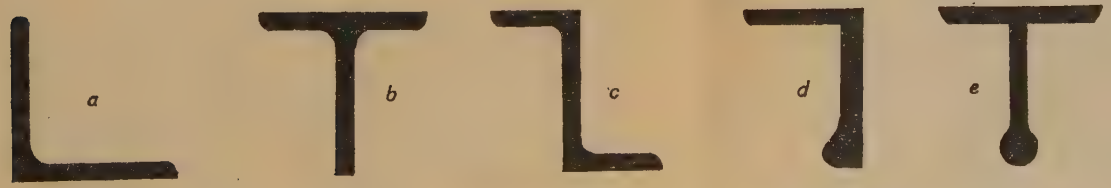



*a.* "Flush counter-sunk rivet" used for outer plating and deck.
*b.* "Boiler point rivet" used for inner bottom plating and bulkheads.
*c.* "Snap point rivet."




*d.* & *e.* "Tap rivets" used in positions where it would be difficult to manipulate hammers. The square projections are cut off when the rivet is screwed home.

*Fig. 4.*




*a.* Angle bar
*b.* Tee bar
*c.* Zed bar
*d.* Angle bulb bar
*e.* Tee bulb bar

of the upper deck beams amidships, although in some classes of vessels, such as steamers having three or more decks, this is varied.

For purposes of easy reference when building a vessel Lloyd's recognise what is known as the "TRANSVERSE NUMBER" and the "LONGITUDINAL NUMBER."

THEN—

$L$ = The Length of the vessel. $B$ = The Breadth of the vessel $D$ = The Depth of the vessel.

In addition, a depth ($d$) is to be measured vertically at the middle of length, from top of ordinary floor at centre, or double bottom at side, to top of the beams of the lowest deck or tier of beams at side

$B + D$ is to be considered the TRANSVERSE NUMBER, and it regulates the frame spacing and scantlings of floors, and considered in association with ($d$) regulates the scantlings of frames, reversed frames, and web frames.

$L \times (B + D)$ is to be termed the LONGITUDINAL NUMBER, and it regulates the scantlings of keel, stem, stern-post, side and bottom plating, double bottom, side stringers, keelsons, lower deck stringer plates, and lower deck plating, and considered in association with the proportions of the vessel, regulates the thicknesses of side plating and deck plating, of upper, awning, or shelter decks, and of long erections

$B$ regulates the number of keelsons. $D$ regulates the number of side stringers.

The length of admidship beams considered in association with the number of rows of pillars regulates the scantlings of beams.

Now looking at all these from a seaman's point of view he must ask himself the question: what are the stresses that a vessel at sea would be subjected to and which are the various parts in her construction to with stand them.

Take pitching into a sea-way first and we find that the stress is put upon, Plating, Keel, Keelson, Stringer-plates and deck.

For rolling, beam seas and other athwartship stresses we have, Bulkheads, Beams, Deck and Shell-plating.

For vertical stresses the Pillars and Shell-plating form the main support, not forgetting the bulkheads

Take again the strain that the masts may put upon that deck where it is wedged, and we find that it is partially met by the diagonal tie plates as shewn in *Plate No. 40.*

So much then for some of the rules that a naval architect and

ship-builder is governed by, and I think that it is sufficient to give an insight into the methods adopted.

In an iron or steel vessel all these members are rivetted or bolted together, so an illustration of a few kinds of rivets is given in *Plate No. 38.*

Without going too far into matters we will follow somewhat roughly the sequence of events during the period of construction.

First the keel is laid on the building chocks, not all in one piece of course, but in separate lengths of about forty feet each. *Plate No. 39* illustrates a vessel with a bar keel, and Section XXXIII deals with steamers having a flat plate keel.

The several lengths are rivetted together by vertical scarphs, each scarph to be of a length nine times the thickness of the keel.

Then the floor plates with frames and reverse frames attached are placed in position over and at right angles to the keel. I have known many officers who were anything but sure as to what the floor plates were so I may here explain that they form the foundation for the bottom of the ship.

They are strong plates, standing vertically (not up ended), about three feet or more in depth amidships, narrowing as they near the bilge of the vessel.

To the bottom of each floor plate is rivetted an angle bar, and in such a manner that one flat side is attached to it and the other flat side is in such a position that the shell plating may be rivetted to it. These angle bars are the frames, and they extend up to the bulwarks.

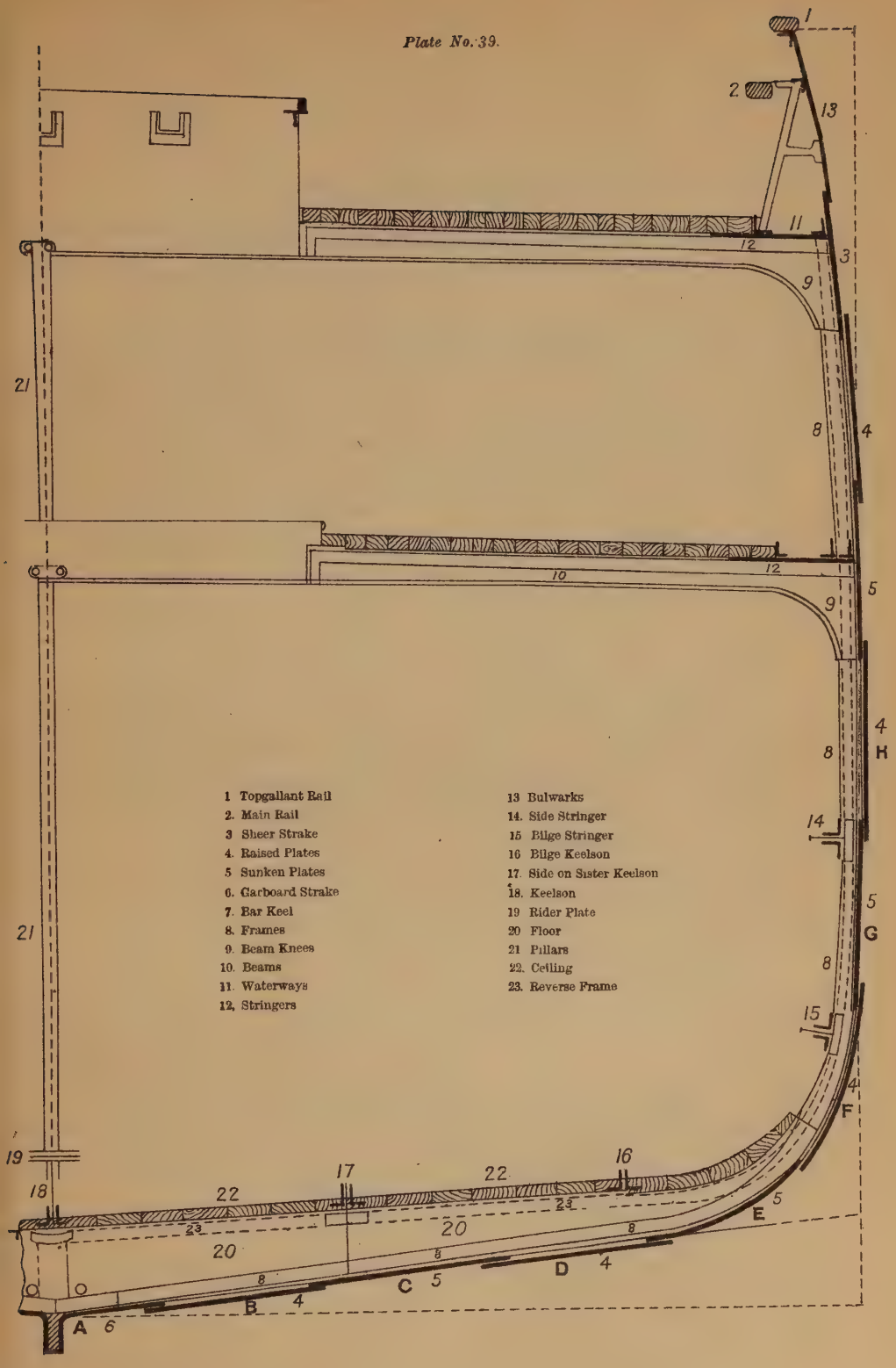
On the top of the floor plates are rivetted, in a similar manner, other angle bars termed the reverse frames, and to these reverse frames the wooden ceiling is bolted.

Following these reverse frames from amidships we shall find that they meet the frames themselves at the outer extremity of the floor plates, then becoming rivetted to each other, back to back, continue their upward journey together.

The beams extend across the vessel from frame to frame, and are rivetted to them by the beam knees. *See Plate No. 38, Fig. 1.*

Running fore and aft on each side of the vessel and resting on the beams are large flat plates that you can walk on. These are the stringer plates, and they, with the help of the beams, assist in keeping

*Plate No. 39.*




1 Topgallant Rail
2. Main Rail
3 Sheer Strake
4. Raised Plates
5 Sunken Plates
6. Garboard Strake
7. Bar Keel
8. Frames
9. Beam Knees
10. Beams
11. Waterways
12. Stringers
13 Bulwarks
14. Side Stringer
15 Bilge Stringer
16 Bilge Keelson
17. Side on Sister Keelson
18. Keelson
19 Rider Plate
20 Floor
21 Pillars
22. Ceiling
23. Reverse Frame

the frames and reverse frames in position whilst the vessel is in process of construction.

In the illustration of the midship section of an iron or steel sailing ship it will be noticed that there are two other stringers below the lower deck beams.

We will next turn our attention to a vertical plate extending in the fore and aft line, and with its lower edge resting on the floor amidships. *(No. 18, Plate 39).*

This is the keelson, and it is secured to the reverse frames by means of short pieces of angle bar or lugs; one outer flat side being rivetted to the keelson and the other outer flat side to the reverse frames.

Sometimes a plate eighteen inches broad is laid between the keelson and the floor plates.

On the upper edge of the keelson is a horizontal plate known as the "Rider Plate," it being secured to the keelson by means of angle bars running in the same direction, viz., fore and aft

Notice how much angle bars are brought into use when connecting up plates that butt up against and run at right angles to each other.

I should also like to mention that which is not always apparent in the hold of a ship of this type, and that is; It is possible to crawl athwartships, between two floor plates, from one side of the midship fore and aft line to the other without going over the keelson.

There are two other keelsons on each side of the one mentioned as you will see in the illustration, and they are termed the side and bilge keelsons, better known perhaps as the sister keelsons. Vertical support is given to decks and beams by means of iron or steel pillars, those in the lower hold being rivetted to the reverse frames and extending upwards to the lower deck beams, to which they are also rivetted, others again have their lower ends on the rider plate over the keelson.

In a similar manner from beams of lower to beams of upper deck these pillars are placed and secured.

As the firmest support will be given when these pillars are vertical it naturally follows that each pillar will extend from that one beam to another, each of which is rivetted to the same frame.

In our previous remarks concerning the stresses that a vessel is subjected to, we included the shell plating as being a factor in each, of resistance.

Now in addition to this we must realize that without the "shell"

or "outside" plating the vessel would not float so we must give it the first position of importance.

Taking the strakes individually—a strake being a line of plates in a fore and aft direction—we will deal with that one which is next to the keel first.

It is marked *A* in *Plate No. 39*, the next one outward being *B*, and this is the method for reference adopted by shipbuilders.

Strake *A* is the "Garboard Strake," and owing to the importance of its position, it being one of the foundations of the vessel with extra strains to bear, it is thicker than the majority of plates.

This plate, or plates, for they are of limited length, is bent in such a manner as to be rivetted to the keel on the lower part, whilst the other part is rivetted to the frame. Each keel rivet passes through three thicknesses of metal, viz., the keel and the garboard strake on each side of it.

To the garboard strake is rivetted the next plate, working towards the bilge, and so on in succession come the other plates or "strakes" until just below the main deck, when another line of plates is reached which also necessitates a greater strength being required; it is called the "Sheer Strake."

The wing or outer planks of the upper deck are in a horizontal plane with the sheer strake, or to be more exact, the outer planks of the upper deck are secured to the upper deck stringer plate, which in its turn is secured by means of angle bars to the sheer strake. *See Plate 38. Fig. 1.*

The result is that this particular line of plates may, owing to heavy weights on deck, seas washing aboard and the inclination of the vessel to "hog" or "sag" (see Nautical terms) receive more strain than those of the plates immediately below it—hence its increased thickness.

The beams, and subsequently the deck planks, are not perfectly flat when the vessel is upright but are arched towards the fore and aft midship line, thus giving greater strength as in the case of bridge-building on shore. This curvature is known as the "Camber" of the vessel. The upper deck stringer plate forms a water way, and to this the water will run into from the deck and thence through the scupper holes, which are of sufficient number and size to release the water under ordinary circumstances.

The most common form of shell plating is known as the "raised and sunken" plate system.

In plate No. 39 the garboard strake, *A* is the sunken plate, it being rivetted directly to the frames of the vessel, and the next plate outward from the keel will be the raised plate *B*, the outer or "landing edges" being rivetted by a double row of rivets to the outside of *A* and *C*. It follows therefore that unless the plate *B* is bent inwardly it would not touch the frame, so strips of iron or steel "liners" of the same thickness as the shell plating are placed along the frame extending from the edge of plate *A* to plate *C*.

Plate *B* is then rivetted by a single line of rivets, each of which will pass through the "liner" as well as the frame and plate itself.

Now in the majority of cases looking at a vessel's shell plating from the outside, the breadth of all plates appear to be equal.

To render this so it is necessary to have the sunken plates as much broader than the raised plates by the breadth of the two landing edges combined.

The plates themselves are from thirty to forty feet in length and about forty inches in breadth.

Where the several plates of a strake butt together they must be made water-tight and strengthened, so a "butt strap" or plate of the same thickness is placed vertically on the hold side of the vessel and double or treble rivetted to the shell plating.

The frequent reference to lengths, breadths and thicknesses as being, "about" is not due to rough and ready methods of terming, but if an endeavour was made to give them more accurately it would necessitate going into "Lloyd's Rules" for scantling, &c., and would become more a treatise on Naval Architecture than Practical Seamanship.

The stem and stern post,—the reader may perhaps think that these two very important structural parts of a vessel have been left until rather late in the chapter, but it is not usual to lift these into position until the frames between them are erected—are of the same thickness as the bar keel and are each scarphed to the keel in the same manner as the several lengths of such are secured together as previously mentioned.

The shell plating extends nearly to the level of the fore part of the stern and to the after part of the stern-post, to each of which it is securely rivetted.

In sailing vessels it is not uncommon to have but one deck, which would naturally be the one over the upper deck beams, to which latter it is bolted if the deck is of wood.

Vessels of a moderate size have wooden decks, generally yellow pine and with the planks running fore and aft, butting over beams.

To each beam the deck is bolted, having the nut end of the bolt under the angle bar of the beam and the bolt head sunken into the deck.

Over each bolt head is a wooden plug having the grain of the wood running the same way as the grain of the deck when the former is driven into position. This plug is called a "dowel" which, with the help of white lead over the bolt heads, prevents the leakage of water through the deck.

The bolts themselves are of galvanised iron, and have oakum and white lead around the neck before being screwed home by the nuts.

As the beams are fitted to alternate frames, and the frames being about two feet apart, the distance between the dowels in each plank will be about four feet, but where the deck planks butt over a beam there will naturally be two bolts and dowels close to each other on the one beam.

Deck planking is generally five to six inches in breadth, and the thickness between three and four inches in foreign going vessels, the latter measurements being governed by the size of the vessel.

Wooden decks on an iron or steel vessel are not of such additional strength longitudinally, viz., fore and aft, as would be the case had they been of iron or steel, and it therefore follows that the more modern vessels have the latter material, even though the size of the vessel does not compel it.

Using the word compel reminds me that Lloyd's Rules state that a vessel whose length is equal to more than ten times the depth or eight times her breadth, and with a plating number of 25,000 or more, must have an iron deck $\frac{6}{20}$ of an inch thick, throughout her entire length.

The thickness of the deck then increases as the plating number increases, and the number of decks also increases. At a distance of not less than half the vessel's midship breadth abaft the fore part of the stern at the lower deck is the "Collision Bulkhead."

This bulkhead should be quite watertight, and any water that may accumulate on the fore part of it, is pumped out by means of a pipe leading down from the deck, having some pumping arrangement fitted at the upper end.

On one side of the bulkhead are vertical angle bars not more than thirty inches apart known as "Stiffeners," and on the other side will

be found horizontal stiffeners of the same type, being not more than four feet apart.

These angle bar stiffeners are reinforced with bulb plates, or web plates, or semi-box beams.

It is not necessary to be a seaman to know and understand that the bow of a vessel, be it a sailing or steam vessel, must be strong compared with the general dimensions. It is not every officer or seaman that knows the arrangements in the fore peak that are conducive to the extra strength of the vessel in that part, so let us imagine ourselves examining them, or, better still, go down there and do so yourself if it is possible and you are in doubt. The plates are rivetted to the stem. but just abaft the stem you will find triangular horizontal plates extending from frames to frames on either side, well rivetted to both

These are the "Breast Hooks."

Notice the strength of the beams—"Panting Beams"—for when a vessel plunges into a sea the stress is inclined to make her pant.

The stringers also are strengthened and are called "Panting Stringers."

At the bottom there are deep triangular vertical plates with their apex down; these are "Wash Plates." Then again if you examine the butt straps inside of the shell plating you will find that one strap connects up three plates.

This is because the girth of the vessel measured from the keel to the upper deck stringers is greater amidships than at the bow or stern, and it means either narrowing the plates or leaving some out.

## SECTION VIII.A.

# ANCHORS AND CABLES.

A large number of young seamen are not aware that there is a special Act of Parliament regulating the sizes and strength of anchors and cables.

The anchor, one of the principal things in a vessel's equipment, is in two parts—the anchor and the stock.

Each part of an anchor is named as in the accompanying plate. *(Plate No. 42).*

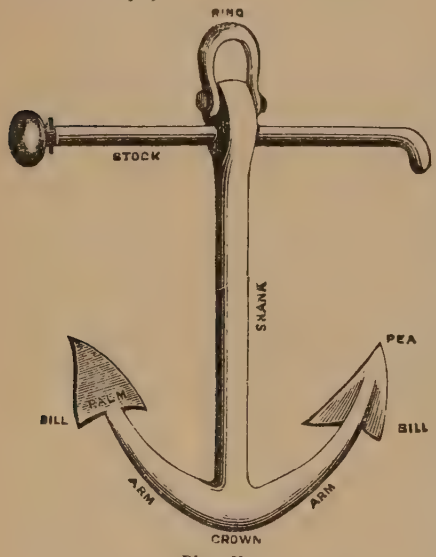



*Plate No. 42.*
The names of the different parts of an anchor. The Palm is also called the Fluke.

The ring, which in most anchors is a large shackle, is for the purpose of bending the cable to the anchor.

The stock forces the anchor to lie the right way on the ground when let go, thus allowing the fluke or palm, which happens to come undermost, to take a square grip of the bottom.

Under different Acts of Parliament relating to shipping generally, and the carriage of passengers and emigrants, and also under the great insurance companies' regulations, there are proper rules as to sizes and numbers of anchors for vessels of different tonnages, and also for the tests to which they are to be proved; in other words, every anchor and cable has to stand a certain strain before it may be carried as part of a British vessel's equipment.

The table here inserted shows the necessary number and size of anchors for vessels of different tonnages, according to "Lloyds'" rules :—

The Anchors and Cables Act provides that a maker or dealer in anchors and cables may not sell or contract to sell—nor shall any person purchase or contract to purchase—for the use of any British ship (vessel) any anchor or cable exceeding in weight 168lbs. which has not been previously tested and stamped in accordance with the Cables and Anchors Acts 1864-1874.*

These tests vary of course with the size of the cable. A few tests are here shewn merely as examples :—

| | | | | Breaking Strain. | Tensile Strain. |
|---|---|---|---|---|---|
| Cable of 1-inch diameter has to bear | | | | 27 tons. | 18 tons. |
| „ | $1\frac{1}{2}$ | „ | „ | $58\frac{1}{10}$ „ | $40\frac{5}{10}$ „ |
| „ | $1\frac{5}{8}$ | „ | „ | $94\frac{5}{10}$ „ | $67\frac{5}{10}$ „ |
| „ | 2 | „ | „ | $100\frac{8}{10}$ „ | 72 „ |
| „ | $2\frac{1}{4}$ | „ | „ | $127\frac{5}{10}$ „ | $91\frac{1}{8}$ „ |

and so on.

The price of good chain cable up to the mark in these respects will probably be from £12 to £15 per ton weight.

Each length of chain which has been thus proved at a testing house bears on a link the test mark, also the letters B.T. and a crown.

Anchors have to bear similar tests according to their weight without the stock, as per accompanying table.†

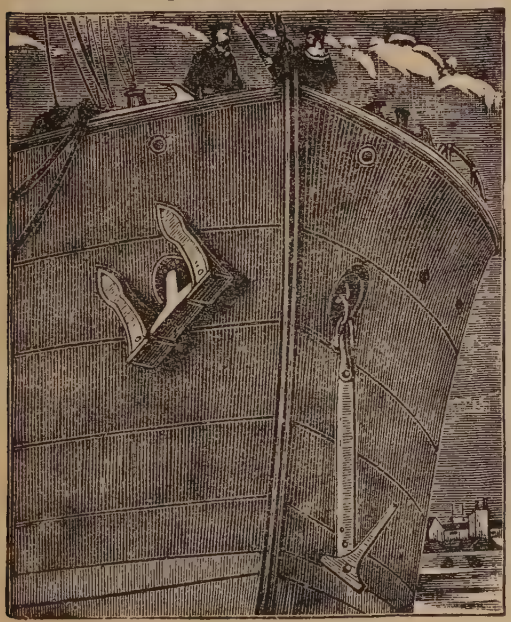


*Plate No. 48.*

Patent anchors of all kinds are to be found in the market at the present time, the more modern types being stockless anchors with movable flukes, which require no stowing, being hove taut into the hawse pipe, where the flukes take the bows, and the anchor remains perfectly steady. These anchors appear to give satisfaction, and are certainly to be got up and stowed in a seaway with much less risk of holing the bow than the old fashioned anchor. A fair example of this kind of

* This weight includes the stock.

† The stock should weigh one quarter the weight of the other part.

anchor is here shewn. It is, however, right to mention that the Navy Authorities have pronounced adversely on these anchors, and they are not supplied to H.M. ships. Many large mail services, on the other hand, have adopted them.

The cat-head and fish davit are fast disappearing in steamers, being replaced by a single 'midship crane, which serves both sides as cat and fish combined. *(Plate No. 44.)*

The cat-head (so termed from the ornamentation on the end of the timber, a lion's or cat's head) projects from the bow, one each side, a heavy purchase is rove in it. When the cable is hove in so that the anchor is close up to the hawse pipe, this purchase, the cat-fall, is hooked to the ring, and the anchor hove up by it to the cat-head the chain being slacked away when first hooked sufficiently to allow the anchor to come up. The fish tackle, from the fish davit, is now hooked, sometimes to a strop or a shackle fitted to the anchor shank for that purpose, but more often under the shoulder of the fluke of the anchor, and the anchor is then hove up on to the bill-board, or right on to the forecastle deck. *(Plate No. 45.)*

With the crane this operation is done in one heave, the crane tackle acting as both cat and fish.

When at sea the anchor is stowed on the forecastle deck, but near land both anchors should be got over the side. They are then hung by two chains; the first, "the cat stopper," hangs the ring of the anchor to the cat-head; the second, "the shank painter," hangs the shank (and the principal weight of the anchor) up to the bill-board (a slight projection on which the bill of the anchor rests). When the anchor is to be let go it is sometimes "cock-billed," that is, the shank painter is slacked away, and the anchor is left hanging by the cat stopper alone. The buoy rope is now bent if the anchor is buoyed (a very good practice), take a half hitch round inner fluke and pass the running eye over the outer fluke, forming a clove hitch over the crown of the anchor. If the bottom is rocky, the first two fathoms of buoy rope should be chain, to prevent it chafing through. At the order "Let go the anchor," the man stationed at the cat stopper lets go by raising a lever which releases a slip link.

But another way which is very generally practised is to have both cat stopper and shank painter led to a single bar, which is freed at both ends by tumblers, or by a single lever amidships, so that the anchor is let go at once from its stowed position without cock-billing. This is termed letting go "stock and fluke." *(See Plate No. 46.)*

*Plate No. 44.*

CRANE FOR CATTING AND FISHING IN ONE OPERATION.

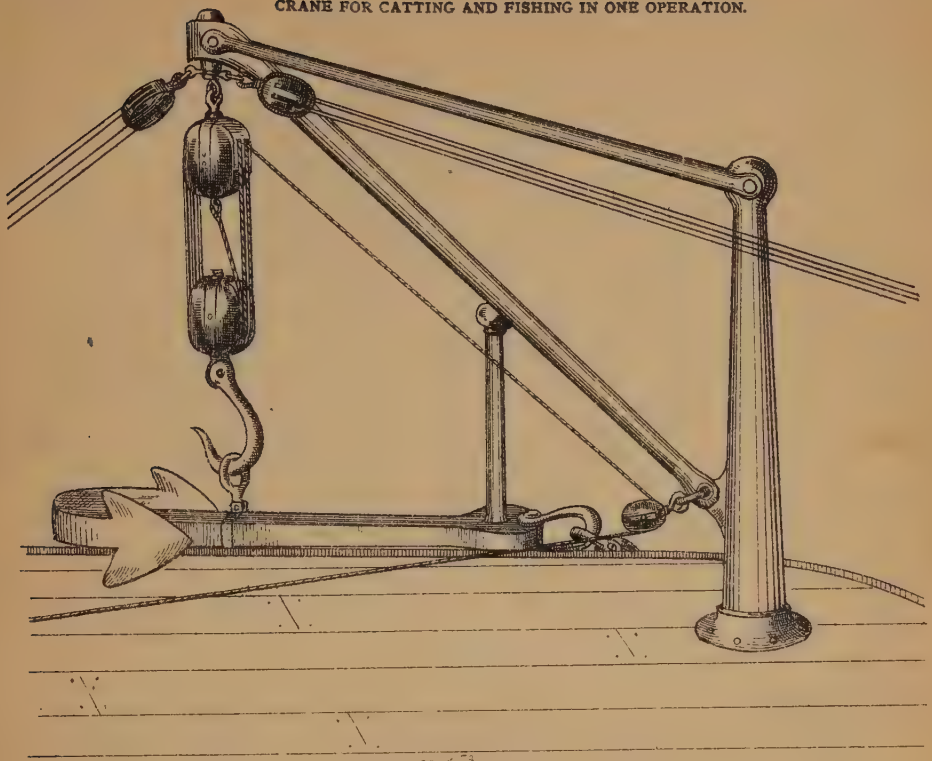


*Plate No. 45.*

FISHING THE ANCHOR.

*a.* The cat, close up, and belayed.
*b.* The Fish being run up.
*c.* The Fish hooked on to the inner part of the fluke.

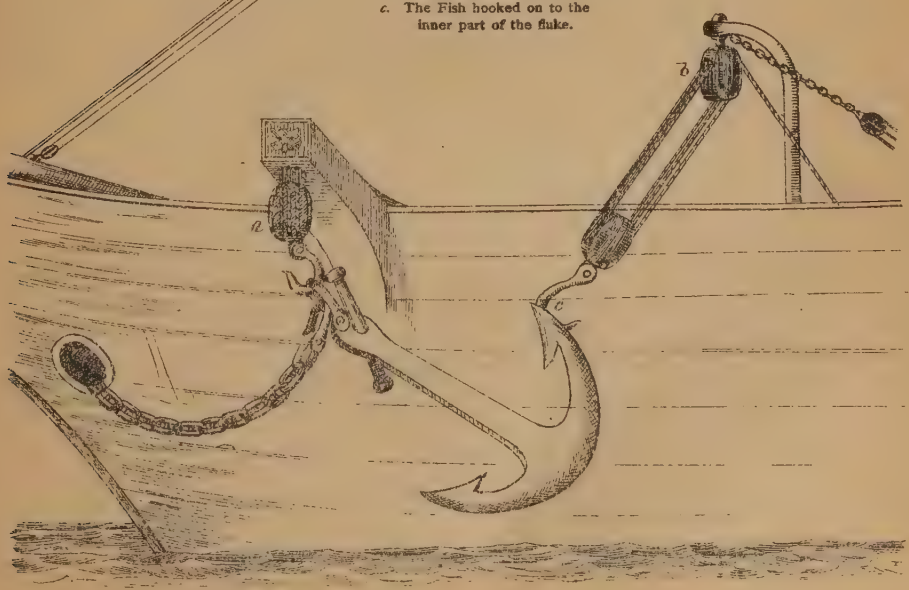
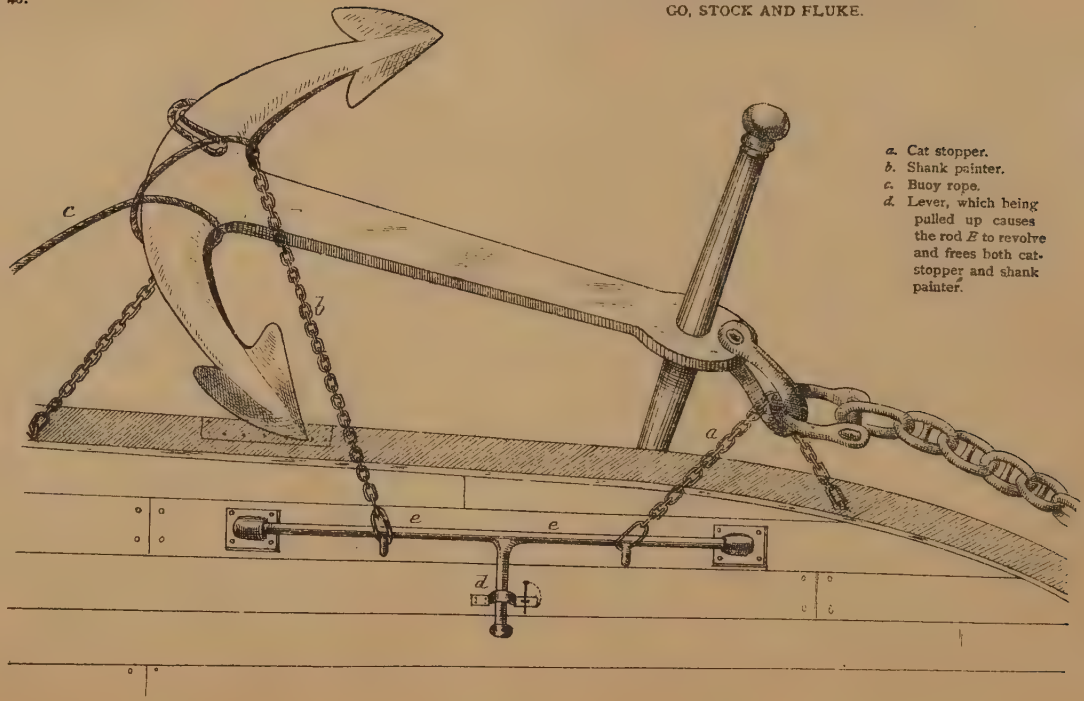


*Plate No. 46.*

PLAN SHOWING ANCHOR READY FOR LETTING GO, STOCK AND FLUKE.




*a.* Cat stopper.
*b.* Shank painter.
*c.* Buoy rope.
*d.* Lever, which being pulled up causes the rod *E* to revolve and frees both cat-stopper and shank painter.

Care must be taken before letting go that (if necessary) sufficient range of cable is on deck out of the locker; that the chain is hanging clear of the anchor; and that the foremost stopper or compressor is *up*.

In preparing an ordinary sailing ship's windlass, the cable is passed from aft over the top, and two turns taken round the windlass. Before letting go see that the windlass is on the squares, that is, with all the pawls taking, the chocks in, the normans in, and the foremost stoppers up.

The method of letting go "stock and fluke" is generally practised in large steam lines; sailing ships generally let go from the cat-head; perhaps the more usual method in ordinary steam vessels is to let go from the hawse pipe. In this case both cat and fish are lowered away, the anchor hove up to the hawse pipe, and both unhooked, leaving the weight of the anchor hanging by the windlass, which at the order "Let go!" is slacked up, and the anchor goes evenly down; and perhaps in such vessels where there are few hands this is the safest way, for unless a windlass is kept in first-rate order, the friction gear soon gets dirty and rusty, and in such a case letting go "stock and fluke" might (if the friction gear held) break the chain, and possibly damage the windlass. From this last cause, however, an anchor let go from the hawse pipe will sometimes be found hard to start; and this method should not be used if the anchor is likely to be wanted at an instant's notice, as it might hang at the critical moment.

When preparing to heave up the anchor the chief thing to see to, especially if there is any sea on, is that the foremost stopper is *down*; this will take link by link as the chain comes in, and prevent heavy jerks on the windlass.

When the anchor is "short," that is, just before it begins to lift off the ground, the master should be informed that the cable is "short." If the order is given "heave away," he ought again to be informed when the anchor is "a-weigh," that is, off the ground; this can at once be seen by watching the cable over the bows, as soon as the anchor is a-weigh the chain will swing in towards the stem, up and down.

If now there is any sea on, great care must be exercised, or the bill of the anchor, as it swings to the hawse pipe, may go through the ship's bow plates. To avoid this the cat and fish-falls should have been ready overhauled down, and the "backs" (small lines on the hooks of the cat and fish-blocks, by which they are swung and hooked to the anchor) led along forward. As soon as ever possible the *fish* should be hooked and hauled tight by hand to steady the anchor;

this can be done as soon as ever the flukes appear above water, and *before* the anchor *clears* the water, and if attended to will often save a hole in the bow.

Whenever an anchor comes in, notice should at once be taken that the pin which secures the ball on the end of the stock, the forelock that keeps the stock in place, and the forelock in the anchor shackle, are all three in their places. Sometimes these get broken when the anchor turns in the ground; they are overlooked when the anchor is weighed, with the consequence that the next time it is let go it perhaps comes up minus the stock, or the shackle-pin works out, both of which accidents would of course endanger the vessel, and might cause her loss.

The young mate, when first taking charge of the forecastle-head, cannot be too careful of these seemingly little things. Before bringing up always see these are right: that the cable is clear for running, and that everything is as it should be about the windlass and compressors.

Where it is customary to let go "stock and fluke," the shank painter should always be passed under the shank, then brought up over the shank, and the end link put over the tumbler; if passed the other way it will be liable to fly up and may hurt anyone who is standing near. The cat-stopper should be passed in a similar way through the ring.

When riding heavy, the foremost stoppers should be kept up, and the windlass drum should not be screwed up by the friction gear if it is possible to secure the after part of the chain with a tackle.

Ships should never ride to an unsupported wooden windlass in heavy weather, but good tackles should be put on the chain forward and abaft, and hauled well taut *from* the windlass each way, to ease the heavy jerks of the cable.

To weather-bitt a cable, pass the bight of the chain under the windlass from aft forward, and over the top of the windlass end, then haul aft taut to the lockers.

## CABLES.

When cables are supplied new, the shackle pins are invariably secured with small iron pegs. Punch out these pegs, and drive in wooden pitch-pine pegs.

The table embodied in this article shows the proper length of bower and stream cables for different sizes of vessels.

Why you discard the iron pegs is, that as the chains become rusty, these iron pegs get so set fast, it is impossible to remove them without making the shackle red hot.

Now, if you wanted to slip your chain in a hurry, there would be no time to heat a shackle, and this might be the cause of the loss of the vessel. With wood pegs, if you want your shackle pin out in a hurry, one or two sharp taps on the end of the pin with a carpenter's maul breaks the peg at once, and the pin can then be knocked out.

When putting in shackle pins, give them a coating of tar or red paint.

If you find a shackle pin very obstinate, and will not start, be careful when striking it with the maul you do not jump the end up. If it does not start after you have struck it several smart blows, then pour some paraffin oil upon it, and get a large shackle punch, made for the purpose, one of which should be on board of every ship and steamer, place this punch on the pin and strike it heavily; this prevents the pin getting jumped up at the end.

But say you have a little time at your disposal, and after the means quoted above have all failed to start the pin, then heat must be resorted to; get some tar and oakum on an iron plate beneath the shackle, set fire to it, and warm the shackle well through, the pin will then punch out without further trouble; heating causes the *shackle* to *expand*, and the heat not getting to the pin, it remains the same size, whilst the hole gets larger by expansion, thus giving the pin freedom.

In putting shackles into the cables, be careful and place the round end of the shackles forward, so that as the chain runs out, they will not catch the inner rims of the hawse pipes. If such an event were to happen, and you were bringing up in deep water, the chances are it would break your chain, and lose the anchor.

See the forelocks of the anchor shackles, that connect the cables to the ring of the anchors, are well secured with a small wire seizing; or some seamen prefer the forelock to have drilled in it a hole, large enough to take a good split ring. The latter plan is to be preferred. This seems only a small matter, but I can assure the reader it is a very important one, for its neglect might cause the loss of many a valuable ship, and anchors innumerable; and the officer on the forecastle-head should always inspect the anchor shackle forelocks before he lets go either of the bower anchors.

Every seagoing ship should have a stream chain proportionate to her size.

There ought to be in the ship's outfit, besides cable and stream chains, 60 fathoms of $\frac{5}{8}$ round chain, for mooring or other purposes, such as kedge work, &c.; it will save a quantity of rope during a twelvemonth, and comes in very handy for many purposes too numerous to mention here.

Coasting steamers usually carry 60 fathoms of such chain, which should be kept in two boxes, one forward, the other aft in the vessel, 30 fathoms in each, and it is found to pay for itself in less than two years, in the saving of ropes alone, when mooring in harbour.

Shackles and chains should be overhauled occasionally, and minutely inspected by the chief officer of the vessel, who should note the same in the ship's log-book.

Ship's cables are generally turned end for end when the first 45 fathoms next the anchor become a little worn. The chain lockers should be periodically inspected, the cables hove on deck, tarred, and coiled snugly away; on these occasions care ought to be taken that the lower ends are properly secured below.

Most of the patent windlasses in general use attach and detach by friction gear; they will either *heave in* cable or *heave it out;* this last property is a valuable one from a labour-saving point of view in many instances. One of the first duties of a mate in these days should be to make himself thoroughly acquainted with his patent windlass and to see that it is clean and in order. With windlasses that work by a messenger chain from a winch, the chain ought to be long enough to slip off the spur-wheel of the winch without unshackling. If the part of the messenger which bears the strain is led over the *top* of the spur-wheel on the winch, by taking a cross in the two parts, it will be found to work better than if led under first; and will free itself better from the whelps of the wheel.

A very general and good plan is to mark, in some distinctive manner, the first few shackles connecting up the fifteen fathom lengths of cable.

Letting go the anchor in fairly deep water and on a dark night, there might be some difficulty in counting the shackles as they pass over the windlass.

A not uncommon method is to secure a piece of seizing wire to the stud of the first link inside, or inboard, of the 15 fathom shackle.

Take three or four turns of the wire round the stud and twist the ends well round one another, hammering them well flat afterwards.

A similar marking should be placed on the second link inboard, of the 30 fathoms shackle, and so on up to the 60 fathoms.

Having checked the cable when a reasonable amount has been paid out after the anchor has reached the bottom, the officer can, when the next shackle appears, feel for the marking and so satisfy himself as to which connection it formed.

Painting the 30 fathom shackle white is of great assistance, for in most cases the brake is put on by the time, or very soon after, this shackle has appeared out of the locker, and its passage over the windlass can be noticed and noted.

*Plate No, 47.*

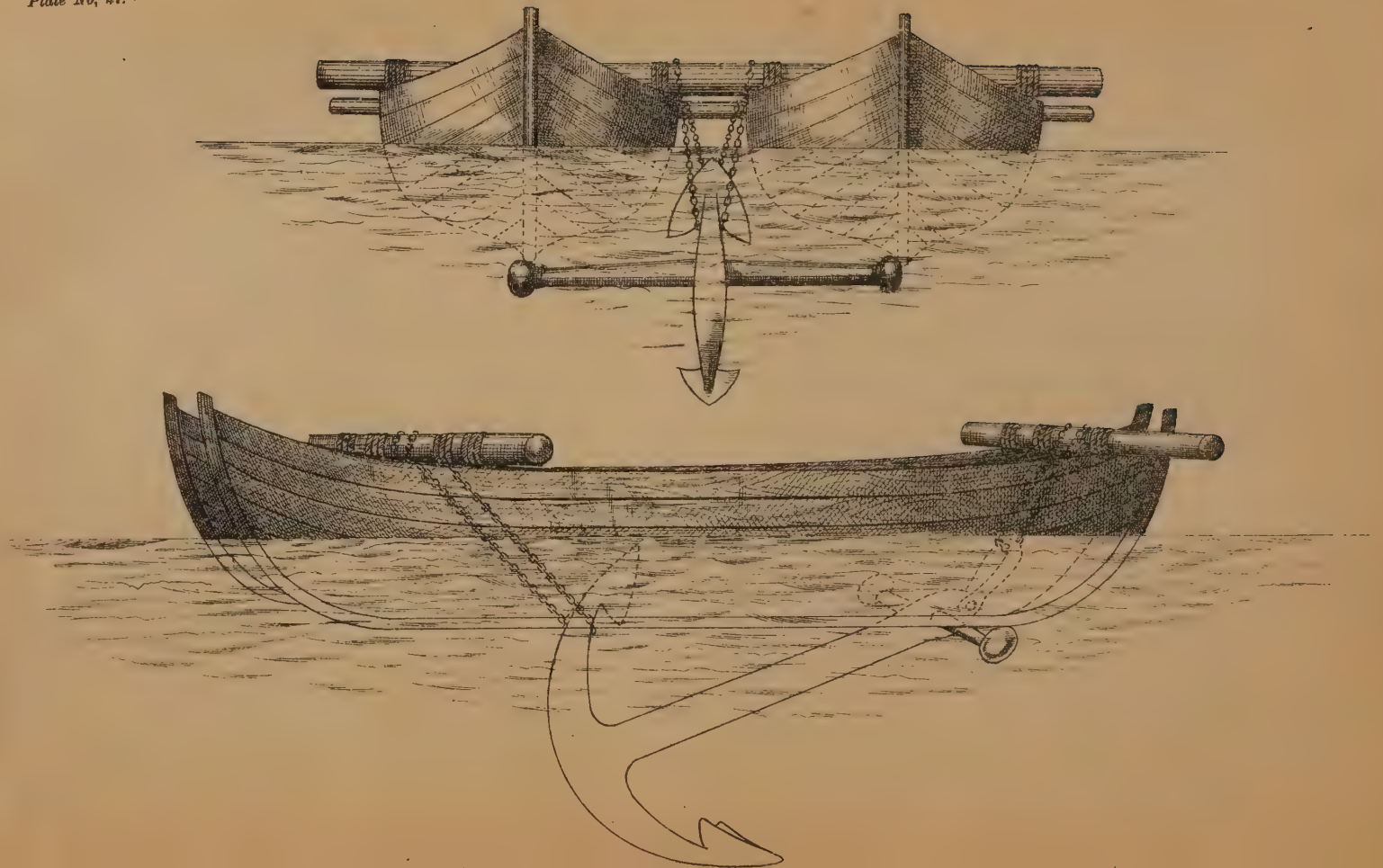
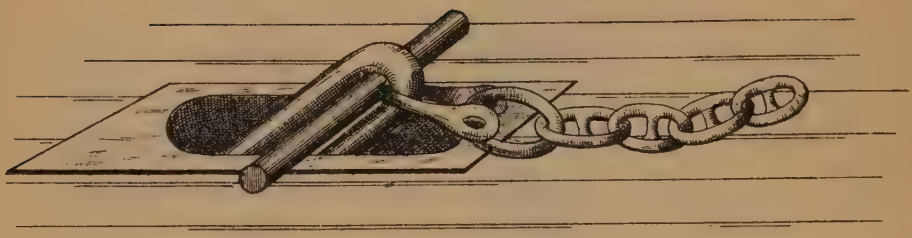
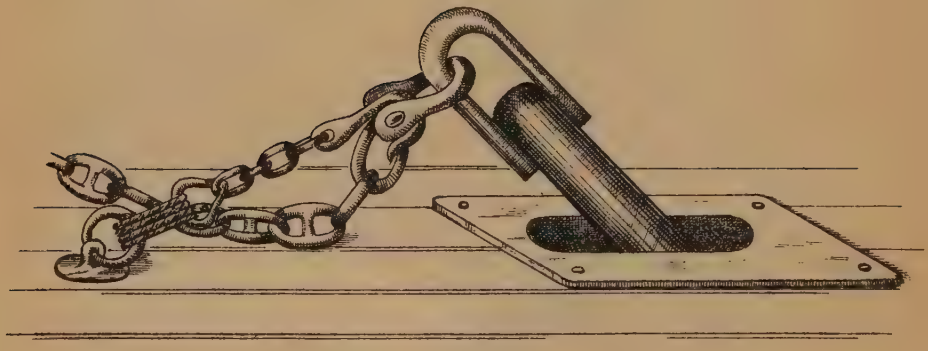


*Plate No. 48.*



Method of securing stockless anchor, when hove up into the hawse pipe.

*Plate No. 49.*



Method of securing stockless anchor.

## TO CARRY OUT AN ANCHOR AND CABLE.

*(Plate No. 47).*

It is occasionally necessary to carry out a heavy anchor and cable, and in these days, when long boats are not carried, this is not an easy matter. So long as it is only a kedge anchor and stream chain, the thing is easy enough; but if it is thought necessary to carry out a heavy bower anchor and cable, and no lighter is available, it must be done by the ship's life-boats. Now the anchor by itself can be managed, but the difficulty is to get the cable shackled on to it and run also.

First run out a kedge with a sufficiently strong warp bent to it as a guess warp, for hauling out the boats by. Lower down your two strongest boats, and protect their bottoms inside with good chafing pieces of wood. Cut a good stout piece of spar, long enough to go across the stern of the boat; flatten one side of it, that it may rest fair across the stern, leaving the top of it rounded. Lash one of these across the stern of each boat, for the cable to run out over. Fit two good rope stoppers to the fore ring of each boat, and one to the stern ring, to lower the cable away in fleets. Mind these are long enough. Now get one of the boats under the bows and stow a fifteen-fathom length of cable in her, unshackling at the fifteen fathom.* (This is quite enough weight for an ordinary boat.) Hang the inner end of the length of chain by a good stopper to the bows of the ship. Haul the boat out by the guess warp, paying out the chain in fleets, by the stoppers, as she goes. When all is paid out, hold on to the end in the boat, and hang her where she is on the guess warp. Bring the next boat under the bow, and pay a length of chain into her, haul her out to the first boat, shackle on to the first length, and pay out again towards the kedge. Repeat this process until sufficient cable is paid out to reach the spot where you are intending to drop the anchor, and buoy the end of the cable above water.

Now lay the two boats fair abreast of each other, about eighteen inches apart. Have a good strong spar (a piece about nine inches diameter will do, unless the anchor is exceptionally heavy); a side of this must be flattened, so that it will lie fair. Lay this across the two boats so that it takes all four gunwales, and it should overlap about a foot each side. Lash this very securely a little before the centre of the boat's length to the nearest thwart, and also to the rings in bow and stern. There should be four lashings, one at each gunwale. (A second light spar may be lashed across the boat's stern after the anchor is lowered down.) Sling the anchor at the middle of the shank, square the fore yard, lash the fish pennant, or any wire span, out to the yard arm, to which hook the fish tackle. Hook on the anchor, having slung it so that it lowers away with a fluke up and the stock horizontal. Lower the flukes down between the

two boats, and hang the top fluke to the spar across the fore ends. Reeve two slip ropes through the ring of the anchor, and hang it to the ring bolts in the boats' sterns, or to the after spar, keeping the stock close up to the boats' keels. Haul away the boats by the guess warps, and when up to the cable end, shackle on and lower away the bight of the cable.

Haul the two boats as far as you can get them along the guess warp, and let go the anchor. Shackle on the home end of the cable, and heave away on board.

Remember to have a good strong buoy rope, with buoy attached, fast to the anchor, as in the event of requiring to trip it again it may be necessary to do so with the boat; in which case take the buoy rope over the stern of the boat (unless you have a proper lead in the bow), put a good tackle on it, and trip the anchor. It need not be weighed if the fluke is lifted clear of the ground, unless you are shoaling the water right up to the ship, in which case it must be kept clear of the ground if possible.

The cable may then be hove away on board, bringing the boat under the bows when the buoy rope may be let go again and the anchor hove up.

NOTE.—Before letting go the anchor from the boats be sure that the slip ropes will run. It will be as well to have a couple of sharp boats' axes handy in case anything jams.

A rough cleat put on the bows of the boats for the guess warp to lead through will be of great help when hauling them along, only it must be strong and well secured.

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## SECTION IX.

## TAKING IN AND RIGGING SHEERS.

As it is sometimes necessary at different parts of the world where vessels trade to take in their lower masts, where no shore masting sheers are available, it will be necessaay to describe in detail the mode of taking in and rigging a pair of sheers with your own crew.

Firstly, then, we will presume the vessel has a large spar afloat on each side of her, with their small ends pointing aft. These spars should be a few feet longer than the distance from the main cap to the main deck.

Middle a good-sized hawser, say an 8-inch rope—larger, if required, if the spars are very heavy. You are now going to rig a pair of parbuckles.

Make a bight of the hawser fast securely to a bit on deck abreast of the mizzen channels, then lead the bight along the deck to another bit or bollard abreast of the main channels The distance on deck between where the bights of the hawser are made fast must be several feet shorter than the length of the spars.

Now throw a bight of each part of the hawser over the rail, and overhaul them down to the water's edge, dipping each bight under-

neath each end of the spar, and pull them well tight; then clap a good luff tackle on to each running part of the parbuckle, lead them well athwart the deck, and rouse the spar up to the level of the rail. If it is likely to catch the channels in coming up the side, or any eye-bolts, &c., place two skids up and down the side to keep it clear.

When the spar is up level with the rail, make two ropes fast, one to the mizzen channels, the other to the main channels; pass the ends round the spar, take them down outside the bulwarks, and thence, through a mooring pipe, on deck. These ropes are for lowering the spar on deck after it comes over the rail. When these ropes are well fast, rouse away the parbuckles and top the spar over the rail, lowering it on deck by these ropes.

Shift over the tackles and parbuckles to the other side, and take in the other spar.

After both spars are on deck, rouse them bodily aft till their heels or large ends are about 6 feet forward of where the mizzen mast passes through the deck, and close in alongside of the waterways.

If the vessel has a high poop, and the mizzen mast steps before the poop, get the small ends of the sheers on top of the poop, with a good tackle; but, if she is a flush-decked ship, lash a strong spar across the ship's rails from side to side, well aft, and place the ends of the sheers on top of this spar. This being done, secure the heels of the sheers with stout lashings, one led forward, the other aft, and place good wooden cleats on the sheers to prevent these lashings slipping down. Under the heel of each sheer leg must be placed a large wood chock, hollowed out a little, called a shoe.

Now get the two small or upper ends of the sheers amidships, lay one over the other, the off leg uppermost—that is, if the mast is to come in on the starboard side, put the port leg on top, and pass a good sheer lashing round them both. This sheer lashing is passed right round both sheer heads, but when passing the turns form a figure of eight with the lashing. After several turns have been taken thus, finish the lashing off with a full set of riding turns over all, and securely hitch the end; also place three good substantial cleats on each sheer leg below the sheer lashing, to prevent it slipping down; for, mind, if this lashing was to slip down with the mast hanging on it, there is no telling what damage would occur. When putting the lashing on heave every turn tight with a heaver.

It generally takes a full coil of 3, 4, or 5-inch rope, according to the weight of the mast, to pass a trustworthy sheer lashing.

Now middle two good hawsers, and clove hitch them round the sheer heads above the sheer lashing. These are called sheer guys. Lead the ends of one forward, the other aft, on each side of the ship, having four good luff tackles ready to place one on each side of these guys. The guys should be led as far forward and aft as possible, to ensure steadiment to the sheers.

Now get your upper purchase block, and lash it round the sheer lashing so that it will hang plumb under the crossing of the sheers, and free to turn in any direction. This lashing must be passed through the eye of the purchase block strop, over the sheer lashing, between the horns of the sheers and down through the block again Some seamen in passing these turns take several turns over each horn of the sheers and through the block. This lashing also takes a full coil of say 4-inch rope, and such a lashing ought, with safety, to lift a 15 ton lower-mast.

This being done, carry forward the lower purchase-block, and with a long pennant, formed by several parts of a good hawser, secure it to the fore bits, then reeve in the purchase-blocks a full fall of 3-inch rope; marry the end of this 3-inch rope snugly to the end of the purchase fall, get a few hands on to this line, and it will reeve the purchase fall without much difficulty. Make the standing end of the purchase fall securely fast to one of the horns of the sheers above the sheer lashing.*

On one horn of the sheers lash a good luff-tackle. The lower block of this tackle is lashed on to the mast just above the cheeks, when it comes above the rail. This is called a topping tackle. Its use is to assist the heel tackles in topping the mast over-end when the heel of the mast comes in over the rail.

Have two good gantlines made fast to the sheer heads to send aloft the top, and such gear as you may require when rigging the mast.

Whilst this is being done send the carpenter below, and shore well up the deck and beams in the wake of the heel of the sheers.

The purchase fall must now be taken round the windlass or to a powerful capstan, and the sheers hove up in their places.

When placing the sheers give them a little rake aft, as they assume an upright position. Tend well the sheer guys. When they become nearly in a perpendicular position, put on the guy tackles in their respective places.

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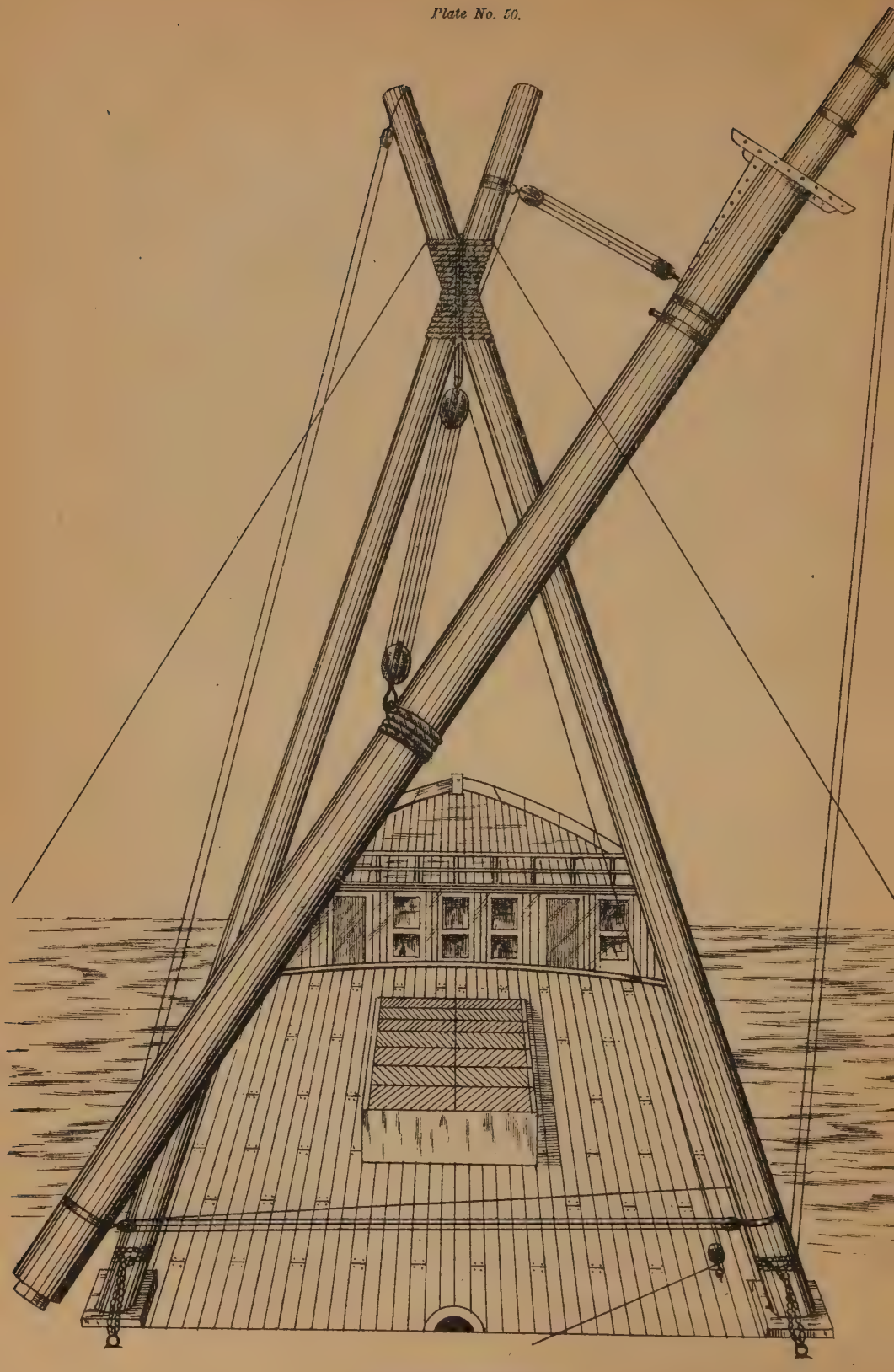
* The purchase should be rove with a cross, so that the fall will come in the middle sheave, to prevent the block canting in the strop.



TAKING IN THE FOREMAST.

A good lashing must also be placed on the heel of the off sheer, over a strong cleat bolted on to the sheer-leg about 3 feet from the heel, and secured to either strong eye-bolts in the water-ways or round the channel plates, to prevent it lifting, as the off sheer-leg has a great tendency to lift off the deck before the mast gets over the ship's rail.

After the sheers are up in their place get a good weight on all the four sheer guys. When these are well fast and secured, let go the sheer purchase and overhaul it down to the water's edge. Have ready two luff-tackles to place on the heel of the mast as it comes inboard, to guy it into its place.

When overhauling the purchase over the side, mind and send it down *abaft* the sheer leg.

Everything is now ready, as far as the sheers are concerned, for heaving in the mizzen mast.

NOTE.—With very heavy sheers it is sometimes necessary to rig a small pair of sheers over the main sheer heads as they lie on the deck, to lift them out of their place until the purchase can get a fair heave on them. These are called starting sheers.

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## SECTION X.

# TAKING IN LOWER MASTS AND BOWSPRIT.

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### TAKING IN LOWER MASTS.

*(Plate No. 50.)*

Generally speaking, the fore and mainyard are taken for sheers, but it may happen that one of these yards is not trustworthy, and you have had to procure a heavy spar to act in its place; if such be your case, then take in the lowermasts on the side of the vessel on which the most powerful sheer-leg is placed; also, if you think the yard-arm which forms the lower part of the sheers is weak, fish it with a good stout spar, and see the wedges of the lashings are put in from the top side, so that they cannot work out.

Now place your sheers properly, nearly plumb, with a slight rake aft withall. See that all the guys are well taut, and the sheer heels are well secured with their respective lashings.

Have three or four good skids up and down the side of the vessel, to keep the mast in coming up clear of channel plates, eye-bolts, &c.

If it is possible, unship the topgallant bulwark in the wake of where the mast comes inboard, for if by any means the weight of the mast gets to bear upon it, it will probably give way.

As you will have to transport the sheers from one mast to another, it is best to take in the mizzenmast first, as the ship having more beam abreast of her mainmast and foremast than she has abreast of her mizzenmast, the sheers will have more spread as they go forward, thereby tightening the sheer lashing, and making the sheer heads more rigid. *(Plate No. 51.)*

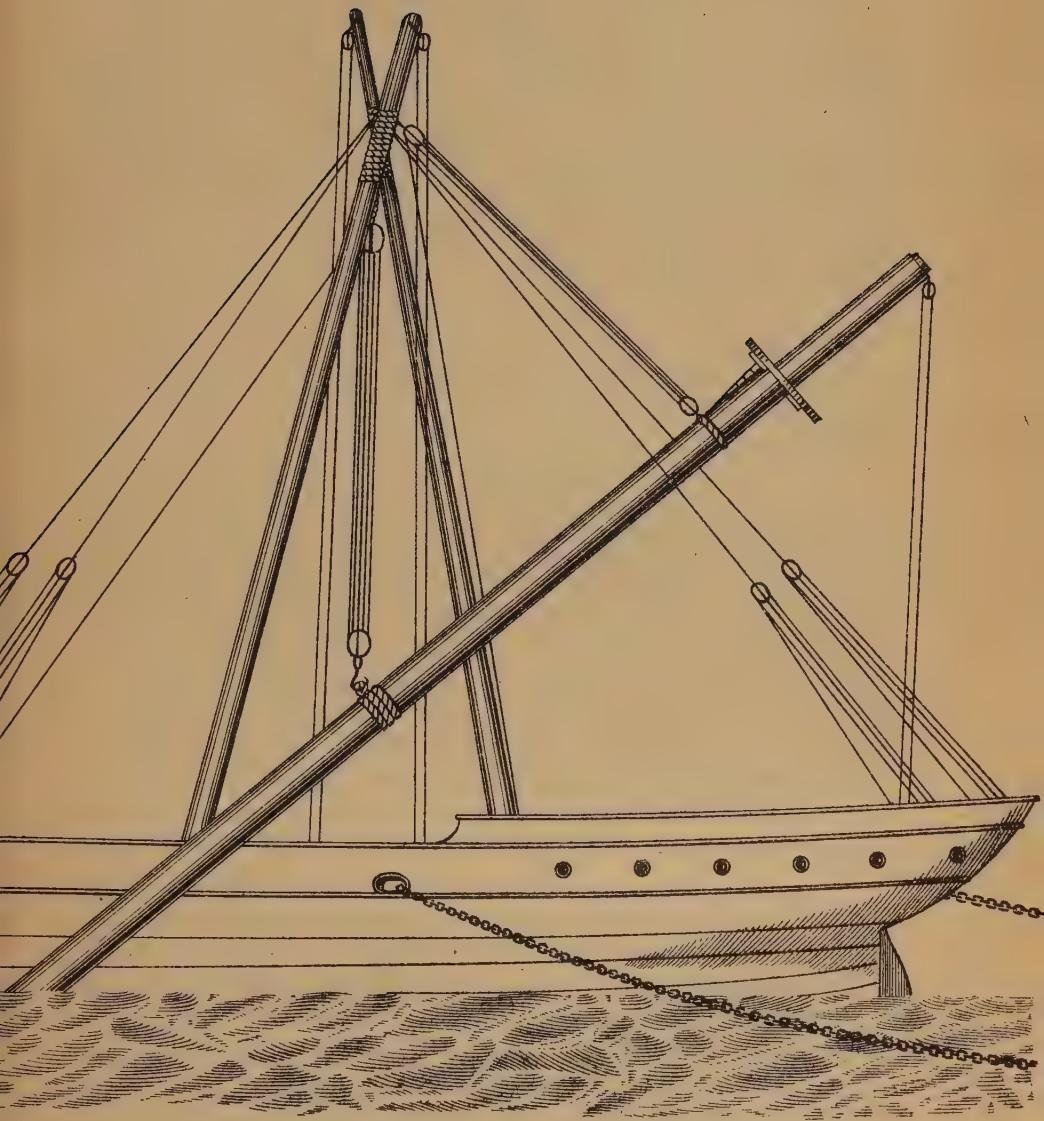
But there are exceptions to this rule. Thus, say the foremast was stepped close to the break of a topgallant forecastle, it would then be prudent to rig the sheers so that the mast would be stepped forward of the sheers, and work aft, taking in the foremast first, and the mizzenmast last.

Now place the mizzenmast abreast of your sheers with the head aft, overhaul down the lower purchase-block, and lash it securely to the lower part of the mast, *be sure* and measure the drift between the two purchase-blocks; measure from the upper deck to the lower part of the purchase-block at the sheer head, six feet less than this is the place, measured from the heel of the mast, to lash on the lower purchase-block, so that when the heel of the mast is on a level with the rail, with the mast right over-end, there is two or three feet drift between the purchase-blocks, and lash the lower block on accordingly. If you have a very deep ship to mast, the upper part of the mast may be the heaviest above the lashing of the purchase-block; if such is the case your topping tackle will require to be a strong one, and under such circumstances it would be advisable to have a good threefold purchase for this tackle.

Use the *greatest care* in lashing on the purchase-block to the mast, and heave every turn of the lashing as tight as possible with a heaver. (This lashing ought to be well-stretched new rope) for if the mast slips through it whilst heaving over-end with the topping tackles, serious damage would probably occur.

If the mast is very smooth, and you have to lash the lower block on whilst it is lying in the water, a good preventative to the block slipping is to take two or three turns of a 3-inch rope round the lower block seizing, and over the heel of the mast, only be sure before doing so that there is room enough in the partners to admit of this lashing passing through all clear. Another plan is, if the partners are small seize on the lower purchase-block to the middle of the mast *temporary*

*Plate No. 51.*



TAKING IN THE MIZZEN MAST.

and lift it up well clear of the water, then hang the mast with a few bights of a good hawser, ease up the purchase, and lash the block on its proper place for good; by this means you can make a secure job of the lashing, then it will require no lashing round the heel.

The writer some years ago saw a large barque taking in a mainmast at Cape Town, and whilst the mast was being lowered the lower block lashing slipped, which let the mast down by the run. Luckily, when this happened the heel of the mast was entered through the between-deck partners, yet nevertheless it damaged the vessel considerably, starting many seams about her bottom, which necessitated the vessel being taken on the patent slip to be repaired before she could take in her homeward-bound cargo.

This will at once show that too great care cannot be exercised when lashing on the lower purchase-block in taking in a heavy mast, and the extra labour expended on heaving the mast out of the water before lashing the block on for good, doubly repays the officer in charge of the work, as his mind is at rest when topping the mast over-end.

We will now assume the lower purchase-block is securely lashed on the mast. Overhaul down the topping tackle, and lash the lower block on just below the trestle-trees, if the latter are on the mast; if not, then just below the cheeks of the mast. Place upon the masthead a good strong tail block and gantline, and have the heel tackles all ready to lash on the heel of the mast when required. All being now ready, take the main purchase fall round the windlass, and the topping tackle fall round the capstan, heave away both together, and when the head of the mast comes just above the main rail, avast heaving and place on the trestle-trees (if they are not already on), as this job is much easier done with the mast in this position than it is when the mast is stepped in its place.

This being done, heave away the mast, and, when it is high enough for the heel to clear the rail, put on the heel tackles and belay the main purchase fall; heave away upon the topping tackle and over-end the mast, steadying well taut the heel tackles as the heel of the mast comes over the rail, and guy it into its proper place. Then lower away the main purchase, tending the topping tackle as required. When the heel of the mast enters the upper deck partners, let go and cast off both heel tackles. Tar well the step and tenon of the mast, and lower it down into its place.

Then place a few wedges in the upper deck partners around the

mast, just to steady it for the time being, and cast off both topping tackle and main purchase from the mast.

Before commencing to transport the sheers forward, bend on the sheer head gantlines to the top, and place it over the masthead, as it is much easier to whip the top over with the sheers than it is to do it when the sheers are removed.

Then pass good tackles forward fast to the heels of the sheers, and take them respectively to the fore winch and capstan; also have good heel tackles led aft to ease away the heels of the sheers, as you heave on the forward heel tackles. Heave the heels of the sheers forward six or eight feet, then top the sheers by the head guys nearly plumb with the heels, and go on thus till the sheers are in the place required to take in the mainmast.

It will be quite unnecessary to describe in detail how to take in the main and foremast, as it would only be a repetition of the above, the evolution being accomplished in precisely the same way.

It may be as well to caution the young officer not to bouse the heels of the sheers too far forward before plumbing them with the guys, as the nearer plumb he keeps the sheers whilst transporting them the safer will the object be accomplished.

Mind and have good trustworthy hands slacking away the sheer head guys whilst heaving on the forward guys, and do not slack them away by fits and starts, but ease them away handsomely, and you will find the sheers are transported along the deck much easier than you anticipated.

Accidents have occasionally happened in transporting sheers, but when such has been the case it has invariably happened through bousing the heels too far forward, and giving the sheers too great an inclination before squaring them up with the head guys, thinking, no doubt, to make long fleets, and get them transported more quickly.

Of course, if you have any amount of men at command, you can heave on the head guys and heels at the same time, and this mode, no doubt, is the best way of transporting the sheers; yet the way ships are manned nowadays in the merchant service, you would not have men enough to man guys and heel tackles at the same time; therefore, you will have to fleet the men about as described above, first to the heel tackles and then to the head guys.

## TAKING IN A BOWSPRIT.

Bowsprits are taken in with either the sheers you have masted the vessel with, inclined forward, and secured to the foremast head, or by

a light pair of sheers rigged on the topgallant forecastle itself, or by a derrick.

Firstly: We will presume your foremast is stepped well abaft the break of a short topgallant forecastle; in that case the masting sheers will take in the bowsprit without much trouble, provided your foremast is a reasonable distance from the stem head.

Take aloft the bight of a large hawser, and clove-hitch it round the foremast head, above the hounds of the mast; take the ends of the hawser well aft on each side of the vessel, and set them up moderately tight with good luff-tackles, to help to support the foremast, which must also be wedged up in the partners.

Place on the sheer-heads a couple of good strong topping lifts, two parts of a strong hawser will do, and make them fast to the foremast above the hounds; place extra heel lashings on the sheer heels forward, and see these lashings are *securely* made *fast*, and *cleated*, as they will have a great strain upon them when you are angling the sheers.

Whilst this is being done, lash a good strong tackle on the head of the foremast, with the lower block secured to the head of the sheers.

This tackle is to help the after sheer-head guys when slacking away the sheers if the angle required to plumb the bowsprit is great, it also supports the sheers whilst arranging the topping lifts. When this tackle is fast, haul it moderately tight, and stand by it.

Place on one horn of the sheers a good topping tackle, to over-end the bowsprit when required.

All being now ready for angling the sheers, slack away handsomely on the after sheer-head guys, till they have the inclination forward required. After the topping lifts are secured, and the after sheer guys securely belayed, overhaul down the lower purchase-block, and lash it securely on the top side of the bowsprit, a little inside of the middle of the spar, but far enough out to allow the bowsprit to go in without shifting it, and secure the topping tackle to the outer end of the bowsprit near the cap.

Make fast two guys, one on each side, leading from each cat-head to the end of the bowsprit cap. A good 3-inch rope rove as a gun-tackle purchase will suffice for these guys.

Heave away both the main purchase and the topping tackle at the same time; when the main purchase is high enough, belay it, and top the bowsprit nearly over-end with the topping tackle, and land the heel of it between the knight-heads, in the partners.

Now clap on two good tackles inboard on the heel, and slack away the main purchase and topping tackles as required, at the same time heaving on the heel tackles, and bed the bowsprit.

To keep the bowsprit down in its place whilst rigging it, the jibboom may be sent out, or a weight may be slung at the end of the bowsprit by a tackle.

In sending down the sheers, it will be best to clap on the after guys, and top the sheers right over-end, and lash them to the rim of the fore-top; as the men, when unrigging the sheers and sending down the heavy gear, can stand in the top, or sit on the lower cap, and work much better and quicker than they could if the sheers were inclined over the bows.

If your vessel has a very long topgallant forecastle, with her foremast well aft, and stepped close to the break of the forecastle, it will then be compulsory to rig a pair of sheers on the forecastle-head to take in the bowsprit; a much lighter and shorter pair will suffice to step the bowsprit than is used for taking in the lower masts.

When about to rig such a pair of sheers, mind and securely shore the forecastle deck in the wake of the heels.

Launch one sheer-leg over the bows, with its small end forward, trending over towards the opposite bow, and secure its heel, temporary, with a lashing; on the opposite side launch out the other sheer-leg, on top of the first, forming a cross with their ends, pass a good sheer lashing, figure-of-eight fashion, lash on your upper purchase-block, and reeve the main purchase fall.

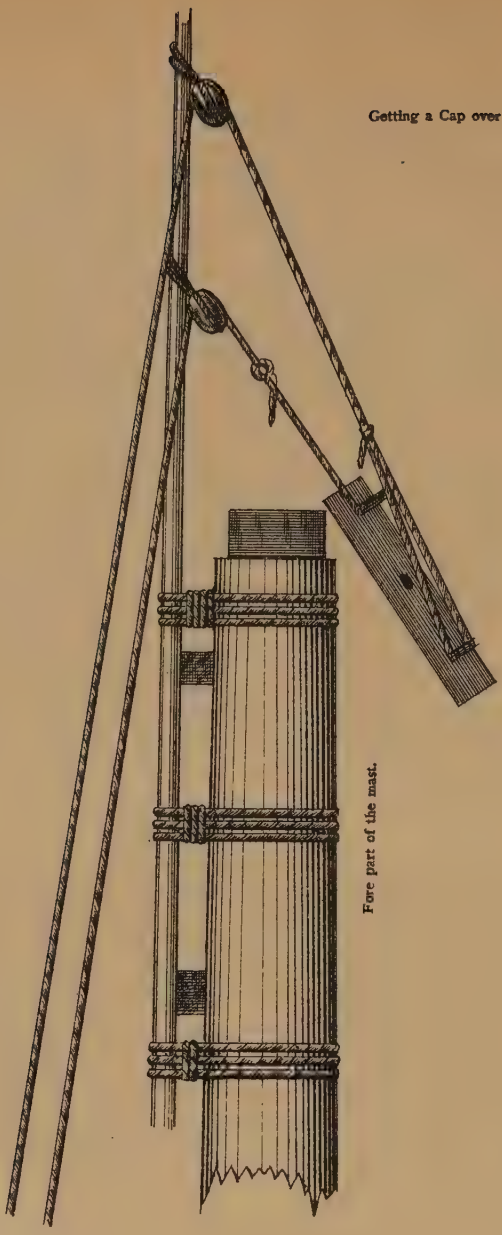
Whilst this work is being executed, get a good tackle on the foremast-head, with the lower block lashed on the sheer-heads; and when this is fast, haul it moderately tight, and tend it. Get good heel-tackles on the sheers, and rouse the heels into their proper place, which should be, generally speaking, from 15 to 20 feet abaft the knight-heads, and secure then with strong heel lashings.

Clove-hitch the bight of a stout hawser round the head of the sheers, and lead the ends up to the foremast-head for topping lifts, then heave away the sheers with the topping-tackle, taking in the slack of the topping lifts round the mast-head as the sheers go aloft, and place then in the required position to plumb the bowsprit. Then proceed as before.

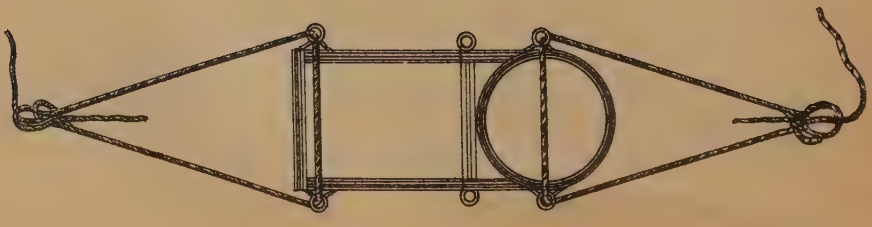
When taking in a bowsprit with a derrick, the heel of the derrick is placed amidships on the topgallant forecastle against the pawl-bit, and the deck well shored underneath its heel. The topping lift is secured to the foremast-head, and strong guys set up from each cat-head to the top of the derrick.

NOTE.—Regarding the getting in of heavy spars. Many large vessels now have steel lower masts and topmasts in one. Very high and strong sheers would be necessary to get such spars on board, and the work is usually done under a crane or a pair of shore sheers. If given sufficient height, the vessel's lower yards, strengthened by the topsail yard, will sometimes be available for sheers; but careful measurements should be taken first of all to see that sufficient hoist can be obtained.

Getting a Cap over the masthead.



Fore part of the mast.



Spanning the cap with the girtlines

*Plate No. 53.*

Fig. 3.

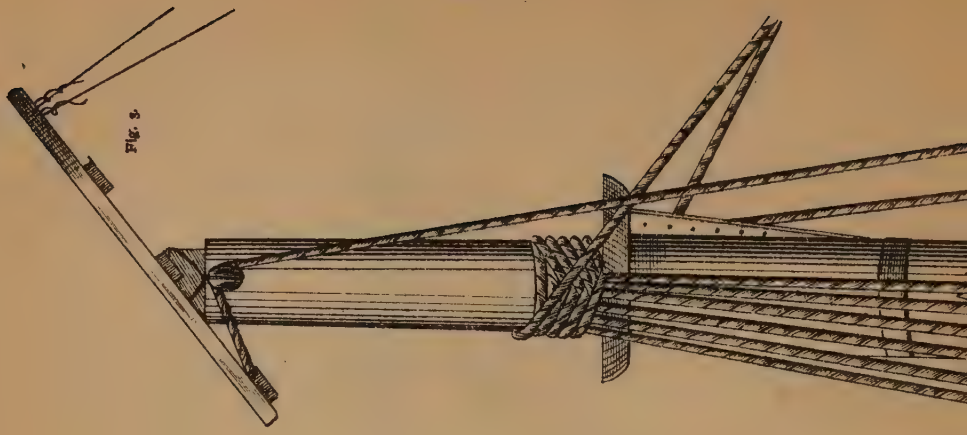


Fig. 4.

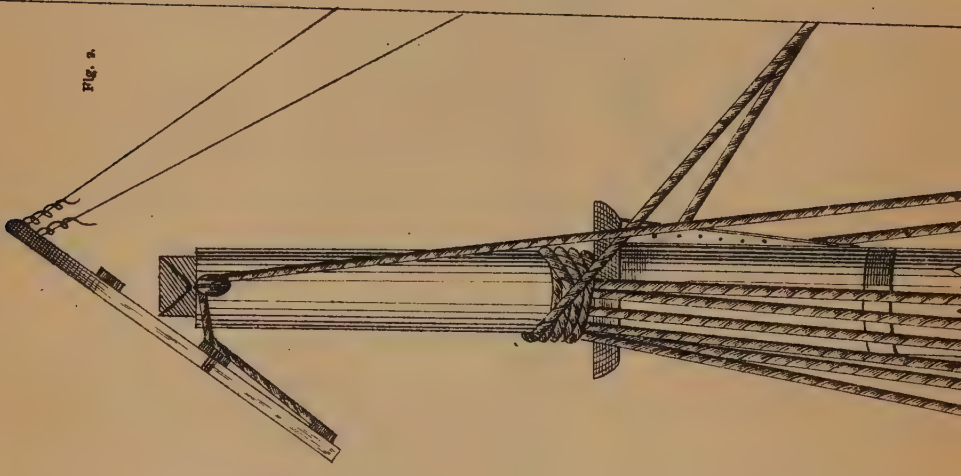
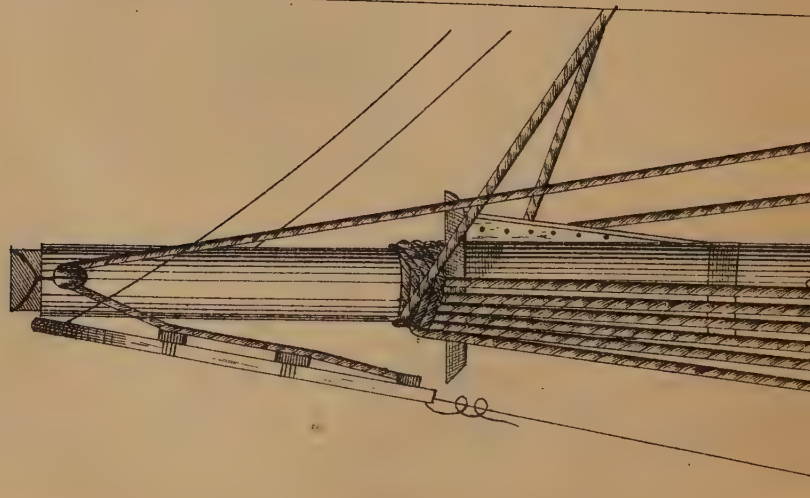


Fig. 5.



## SECTION Xa.

# SENDING ALOFT TRESTLE-TREES, TOPS, CAPS, AND CROSS-TREES.

*(Plates No. 52 and 53.)*

The easiest method by far to get the lower trestle-trees over the masthead is with the masting sheers. (In iron masts they are a part of the mast.)

Take a short piece of stout rope and span the fore end of the trestle-trees. On the middle of this span hitch the sheer-head gantline, make fast to each after horn a tripping line, and pass the ends as far aft on deck as possible on each side of the vessel.

Sway away the trestle-trees till they are just above the lower masthead; then steady well tight the tripping lines and guy it over the masthead, and lower it down into its place.

But supposing no sheers are aloft, then lash a strong spar on the after part of the mast, so that its upper end will be ten or twelve feet above the lower masthead, and its lower end some distance below the cheeks of the mast. Place between this spar and the mast good chocks, to admit of the after chock of the trestle-trees passing down between the spar and the mast.

On the spar, about six feet above the lower masthead, lash on a good block, and reeve in it a line strong enough to send the trestle-trees aloft; also on the upper end of the spar lash on a small block, and reeve in it a handy line. For the sake of brevity, we will designate these ropes the large and small gantlines.

Overhaul these gantlines down on the fore part of the mast, and bend the large gantline on the after part of the trestle-trees, and the small gantline on the fore part. Then sway away, and when the after chock of the trestle-trees comes a little above the masthead, make fast the large gantline and pull upon the small one, which will cause the trestle-trees to assume a horizontal position above the masthead, and they can easily be lowered into their proper place.

Tops can be placed on the mast with the sheer-head gantlines in the same manner as described above with the trestle-trees.

But if no sheers are available, act thus:—

Place the top athwart the deck on the after part of the mast, with its forward rim uppermost. Overhaul the masthead gantlines down on deck abaft the mast, and hitch their ends on each side of the hole

to the after leg of the top, on its under side, and stop the gantlines to the middle and foremost legs.

Then make two small lines fast to the fore part of the rim of the top, and lead them outside the rigging on each side of the vessel as far forward as possible. These are called guide lines. Also make a tripping line fast to the after part of the top, to trip it out clear of the after horns of the trestle-trees as it goes aloft.

All being now ready, sway the top aloft, and when the rim comes on a level with the lower masthead keep a good weight on the guide lines, and cut the foremost or upper stops. The top will then cant partly over the masthead. Sway up a little higher and cut the middle stops, pulling away at the same time on the guide lines, when the top will go over the masthead, and can be lowered into its place with the gantlines.

NOTE.—The seaman who is sent aloft to cut the above-mentioned stops should be slung in a boatswain's chair, and let him keep on the after side of the mast as far as possible till the top comes down over the masthead as far as the gantlines will allow it, as the fore part of the top generally goes a few feet down with a jerk when the middle stops are cut; therefore the seaman wants to be wary who has this duty to perform.

The lower cap is fitted on the masthead after the top is aloft, and is a very easy matter to accomplish, compared to placing the trestle-trees and top over the masthead.

Of course, if the masting sheers are available, place the cap on with the sheer-head gantlines in the same manner as before described in shipping the trestle-trees.

But if no sheers are aloft, proceed thus:—

Overhaul the masthead gantlines down on deck before all, and bend them on the under side of the round hole in the cap, stopping them on each side to the middle and after part of the cap. Also make two short pieces of rope fast, about a couple of fathoms in length each, to the side bolts in the cap. These lines are to assist the men in the top guiding the cap on, and prevent it capsizing forward when cutting the stops.

Now pull aloft the cap, and when its after part comes on a level with the lower masthead, tend the small guide ropes in the after part of the top on each side, cut the stops as required, ship the cap, and beat it down into its place with a top maul.

A cap may also be placed over the masthead very easily when sending up the topmast, thus:—

Send the cap aloft, and land it in the top with its round hole over the square hole of the lower trestle-trees, and lash it in that position.

When the topmast is well entered through both trestle-trees and cap, cross lash the latter on the topmast, then heave away the topmast, and when the cap comes above the lower masthead, place a large handspike in the fid hole of the topmast, with a line fast to its end. Haul away upon the line. This will slew the topmast round, and when the cap comes fair with the masthead, lower down the mast a little, which will ship the cap. Then set it hard down in its proper place. A heavy topmast cap may be shipped in a similar way by help of the topmast.

To send the cross-trees aloft, place two gantlines on the lower masthead, one on the fore-part, the other on the after part, and overhaul them down on deck before all, say on the port side of the vessel, and hitch the ends respectively on the underneath side to the two port horns of the cross-trees.

Stop the gantlines close up to the port side of the trestle-trees, also stop them again half-way out on the under side of the starboard horns of the cross-trees, then make fast a tripping line to the lower part of the cross-trees, to trip them out clear of the rim of the top as they go aloft.

Sway away, and when the cross-trees come above the top, make fast to the upper or starboard horns a couple of pieces of ratline line, to act as guide ropes, and carry their ends over to the starboard side of the top. Station two men to tend them. Sway away the cross-trees till the starboard horns are well above the lower cap, when the upper stops will be close up to the gantline blocks. Haul well taut the guide ropes, and cut the upper stops. The cross-trees will then begin to cant over on the starboard side of the cap. Sway up a little higher, *tending well the guide lines*, and cut the lower stops, when the cross-trees will fall right across the cap. Then pinch them forward carefully, and lash them securely on the cap through the eye-bolts to the lower masthead, with their square hole above the round hole of the lower cap, so that when the topmast is sent aloft it will pass through its proper place in the cross-trees.

Great care is absolutely necessary, when cutting the lower stops, in tending the guide ropes, or the cross-trees may cant off the cap, endangering the safety of the men in the top, and also retarding the work. The man who cuts the stops should remain on the opposite side of the mast on which the cross-trees are sent aloft ; then, if the cross-trees were to slip off the cap during the operation, he will be in comparative safety.

If the cross-trees have to be put over the masthead with the topmast

fidded, the same evolution is carried out as in placing them over the lower cap, only the gantlines will be at the topmast head instead of the lower masthead.

But it is as well to remark that if a very heavy pair of topmast cross-trees have to be shipped with the topmast over-end, the best and safest mode of doing so would be to at once rig a small spar, as before explained in sending up a large pair of trestle-trees; and in fact, all things considered, both in sending aloft caps and trestle-trees, and also in stripping the mast and sending them down, a spar rigged as before described will be found the quickest and much the safest method that you can adopt, if no masting sheers are available.

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## SECTION XI.

## TAKING IN AND RIGGING A LOWER YARD.

We will presume the yard is on the starboard side. Reeve a three-fold purchase capable of lifting the yard. Lash the upper block of this tackle round the doublings of the mast, just below the top, so that it hangs fair and plumb between the lower trestle-trees on the fore part of the mast; then overhaul this tackle and lash the lower block to the yard close to the sling band. Be sure that when the yard is high enough there will be enough drift between these blocks to allow of getting in the sling shackle.

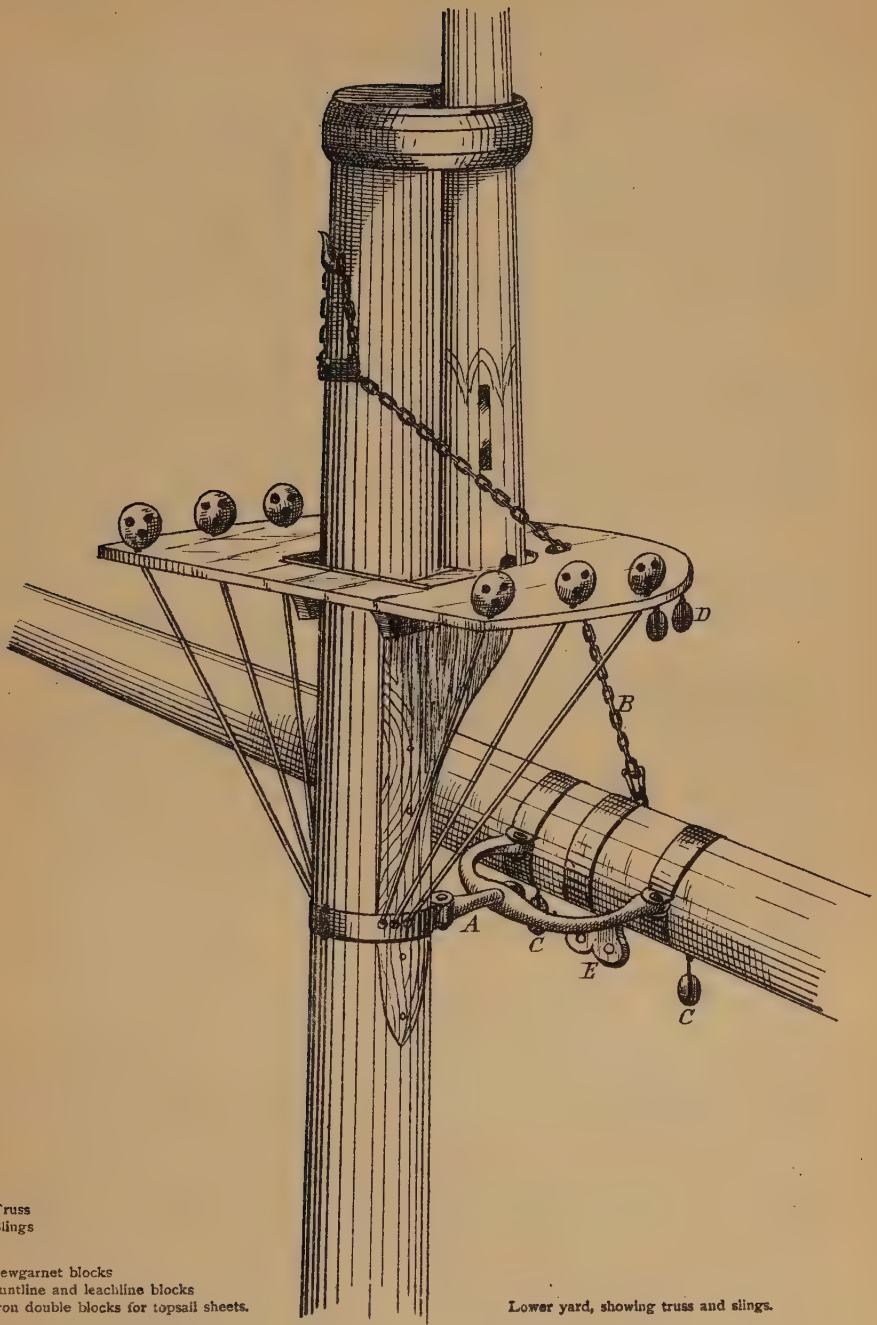
Heave away the yard, and as it comes on board, guy the port yard-arm underneath the fore-and-aft stay, and land the yard right athwart the ship's rails, keeping considerable weight on the tackle, so as to ease the weight off the rails.

The yard is now ready for placing the rigging. (It is presumed that the lifts have already been fitted and overhauled down, ready for shackling on to the yard.)

Firstly, fit the Flemish footropes—these are generally fitted with clip hooks on the one end, and an eye-splice in the other—the clip hooks are moused upon the bolt at the yard-arm, and the eye-splice seized upon the jackstay, about five feet inside the left band.

The footropes are then fitted thus:—A piece of chain about two feet in length, with a shackle in one end, a large link in the other, is secured to the outer end of the footropes by splicing it through the large link. On the inner end of the footrope is spliced an iron heart-thimble, to which is spliced a piece of ratline line for a lanyard.

*Plate No. 54.*




*A.* Truss
*B.* Slings

*C.* Clewgarnet blocks
*D.* Buntline and leachline blocks
*E.* Iron double blocks for topsail sheets.

**Lower yard, showing truss and slings.**

Carry out the footrope on the yard, and shackle it on to the iron band abaft the yard-arm. (The lift-band of a lower yard has generally three large eye-bolts in it, which should be clunk or through-welded; one for the lift on top of the yard; one for the reef-tackle below the yard; and one on the after part of the yard, for the brace and footrope.) The stirrups are spliced round the footropes on one end, the other end having an eye-splice in it to seize on the jackstay.*

(The inner end of the port footrope is seized to the starboard arm of the truss, and the starboard footrope to the port arm of the truss.)

Lead along your braces and shackle the pennants on to the eye-bolts at the yard-arms. Then take two good stout lines or tackles, and make them fast to each quarter of the yard, and lead them forward to the winch or windlass.

Send the truss aloft, and secure it in its proper place, and have it triced up ready to receive the bolts. When trussing the yard, the slings also must be fitted in their place. *(Plate No. 54.)*

All being now ready, heave up the yard till it is high enough to get the lifts shackled on. When this is done let hands keep taking in the slack of the lifts as the yard goes aloft.

When the yard is high enough, take a heave on the two lines or tackle you previously made fast to each quarter of the yard, and pull the yard out clear of the truss.

When the yard is high enough, at once shackle on the slings, and when this is done, ease away the purchase-block fall, till the slings have the weight of the yard.

When this is effected, truss the yard by shoving in the truss-bolts. It is often difficult to get these bolts in place; but by topping first on one lift, and then on the other, and tending well the tackles for heaving the yard forward, you will eventually succeed in getting the bolts in. Secure them with good split forelocks or a large nut, whichever way the truss may be fitted.

After the truss is bolted, square the yard by the lifts and braces, cast off the lines, and unreeve the purchase.

Reef-tackles, buntlines, leechlines, and clew-garnets are next rove in

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* NOTE.—Footropes are often fitted with a long shaped link in the end of the chain, which fits on over the lift-bolt, but they are best fitted to the *brace* bolt, being there more out of the way of the sheets, and are also better *shackled* in their place.

their respective places, and when the gaskets are placed on the yard it is all ready for bending the sail.

The clew garnet-blocks are iron-bound hook-blocks. They hook on an eye-bolt underneath the yard, near the sling-band. Some vessels have a double block, one sheave for the clew garnet, the other for the reef-tackle; but two single blocks are better than a double one here, as each block then lies to its own work.

The buntline blocks are iron-bound hook-blocks, that hook on eye-bolts on the underneath part of the top on the fore side. Here also the leechline-blocks hook on, which are iron-bound hook-blocks. There are also two rope stropped-blocks, one-third of the way out on the yard, seized on the jackstay, that the leechlines are rove in before they are rove in the block underneath the top. The reef-tackle upper block, if reef-tackles are fitted, is hooked on the eye-bolt that is underneath the yard, on the lift-band.

The lower lifts are rove through large iron-bound blocks hooked on the lower cap; the lower lift pennant-block is spliced in the lower end of the lift pennant, and should be a double block, to take the lift fall; the lower lift fall-block hooks on an eye-bolt on deck, close to the mast.

The sheet-blocks of the courses are heavy rope-stropped blocks, with an iron thimble seized into the strop, and one is shackled on to each clew cringle of the course.

Tacks are generally stout round chain, though sometimes of heavy rope; but a tack tackle is used when bousing down the tack, the slack of the chain taken in, and the tack tackle unhooked when the sail is set.

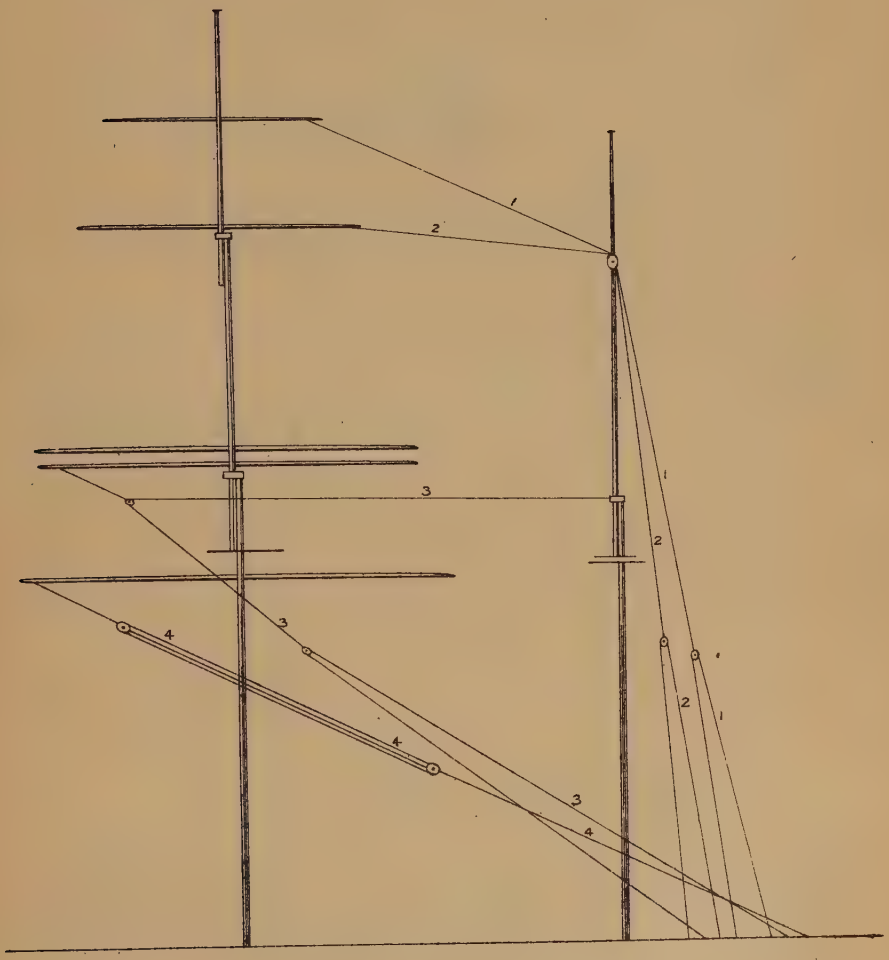
Buntlines, of which there are two each side, can be either rove singly or with a whip and pennant; in large ships the latter is necessary. It formerly was the practice to reeve the buntlines on a bight through a sister block; then the one whip acted for both inner and outer buntline; but this plan is now generally condemned, and each buntline has a whip and block of its own.

Double rope tacks are also to a great extent done away with, as chain tacks are much handier, and can be easily unhooked when going about.

All lower braces should be fitted with patent blocks. Main brace lower blocks are generally fitted with a wire pennant, 3 fathoms in length. The lower block is spliced into one end of this pennant; the other end of the pennant is shackled on to the bumpkin. This block is fitted with a fairleader on it, for the hauling part of the brace to lead through. This arrangement keeps the lower pennant-block from

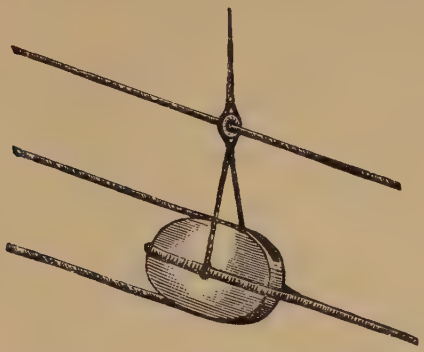
*The most modern fashion for braces is to have all except the lower braces fitted of wire, even to the royal and skysail braces, with a whip down abaft, the lead being as in the sketch.*

THE MOST MODERN METHOD OF FITTING BRACES.




1 1 1 Royal brace } Wire pennants with rope whips abaft the mast
2 2 2 Topgallant brace }
3 3 3 Topsail brace. Wire pennants and rope whip
4 4 4 Lower brace. Do. do. purchase

*Plate No. 55.*



Lower block of main brace, shewing fair lead for hauling part, and tricing line for keeping block up.

*(Plate No. 56.)*

getting turns in it. This fairleader has a small line spliced on top of it, about 6 fathoms in length, that is secured well up the mizzen rigging, to prevent the pennant and block falling in the water when the main brace is let go by the run.

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## SENDING DOWN A LOWER YARD.

Having mastered the methods of sending up and rigging a lower yard the matter of sending it down again is not so difficult. One might be tempted to advise: reverse all the order of the work, and this would not be far out, but an exception must be made in the case of the lower yards. We commenced this section by presuming that the yard was outside the vessel and had to be taken on board, and that the port yard arm was leading forward.

In this case we will presume that it is aloft, and that we require it to be laid on the starboard side of the deck.

Now if you have ever seen sailing vessels laying in a tier side by side, or sometimes when moored alongside of a quay, you may have noticed that the lower yards are often cock-billed, that is to say, one yard arm is well up and the other well down.

If the yard-arm that is down was brought to the rail you would find that it projected well over towards the water: therefore to send that yard down and lay it on the starboard side of the deck, the starboard yard arm is not the one that ought to come down first, on account of the difficulty of getting it under the rigging.

We have also to consider the question of sending it up again, so the easiest methods must be adopted. Secure the upper blocks of two good tackles to the topmast head and lash the lower blocks, one on each quarter of the yard so that there would be a distance of about twenty feet between them.

This will give you a good drift to work with, and will avoid the pull towards the mast that securing the upper blocks to the lower mast-head would entail. The lower block on the starboard quarter of the yard—in this case—should have a lashing in towards the bunt of the yard, or the two lower blocks with a lashing in between them and to each other would be the safest plan, as there would be a tendency for the starboard side tackle to slide towards the yard arm when that end was lifting. Rig a tackle from the bunt of the yard to the fore stay, or well forward on the forecastle head, to keep the yard off the mast as it was lowered.

Heave a steady strain on the mast head tackles and then unsling the yard.

Heave a sufficient strain on the forward leading tackle so as to untruss.

When this is done: heave away on the starboard quarter tackle and tend the port quarter tackle in such a way that will the easier assist in bringing the yard to a vertical position.

Now secure a tackle block to the port yard arm, and make the other block of the tackle fast well towards aft and so that the fall leads aft.

By means of this purchase the port yard arm can be hauled aft on the starboard side and the two main purchases and fore stay tackle slacked away in a seamanlike manner to avoid unnecessary jarring or striking the yard against the deck, or obstacles that have to be avoided

With the yard in this position it will be ready to send up again on the same principle.

No mention has been made of unrigging the yard, as that has been gone into only in a reverse manner, at the earlier part of this section

## SECTION XII.

## SENDING TOPMASTS AND TOPGALLANT MASTS ALOFT.

Take aloft a full-sized top-block, and hook it on the lower cap, on the same side of the vessel on which the topmast is lying on deck; place a good mousing upon it, to prevent it unhooking whilst doubling the mast-rope.

Send aloft as stout a rope as the block will take, and reeve it from aft, forward, and overhaul the end down on deck through the hole in the lower trestle-trees before the rigging; if the lower yard is aloft, brace it forward, and send the mast-rope down abaft the yard.

Reeve the end of the mast-rope through the sheave-hole in the foot of the topmast, overhaul through about ten fathoms of the end, and just above the sheave-hole rack both parts of it securely together; let it be a good racking, as it will have a strain upon it when doubling the mast-rope. Hitch the end of the mast-rope through the sheave-hole in the head of the topmast round its own part.

All being now ready, sway aloft the mast, and when the sheave-hole comes above the lower trestle-trees cast off the end of the mast-rope, and reeve it through the eye-bolt on the opposite side of the cap to which the top block is hooked. When the sheave-hole at the topmast-head comes above the lower cap, avast heaving, and place through the sheave-hole a large iron bolt, ease away the mast-rope till the bolt has the weight of the mast.

Then cast off the racking on the mast-rope, and hitch its end securely to the before mentioned eye-bolt in the cap, set taut the mast-rope, and withdraw the bolt.

Your mast-rope is now doubled, and you can either ease it down a few feet to get the rigging and topmast cross-trees over the masthead, or heave away upon the mast-rope, fid the mast, and rig it aloft.

If the topmast goes up very tight the last few inches, as soon as ever the fid-hole comes above the trestle-trees shove a large bolt through it, then if the mast-rope was to carry away just before it was high enough to fid properly, no damage would occur. Why this is mentioned is, that it often happens that the topmast, through a bad fit in the cap, or being too stout in the shoulders, is very difficult to fid, and has often to be eased before it can be got into its proper place.

## SENDING ALOFT AND RIGGING ROYAL AND TOPGALLANT MASTS.

We will assume in this description that the royal and topgallant rigging has been previously fitted over the mast on deck, and that it has been sent aloft to the topmast cross-trees ready to place over the masthead.

Royal and topgallant masts are usually made out of one spar, except in a few isolated cases, where large vessels have been rigged with fidded royal masts.

On one of the eye-bolts in the topmast cap hook on a good iron-bound block, reeve in it (from aft forward) the mast-rope, and overhaul its end down on deck through the hole in the topmast trestle-trees and the collar of the topmast stay.

Reeve it through the sheave-hole of the topgallant mast, and overhaul about 5 or 6 fathoms of the end through—enough to double the mast-rope when required. Then hitch the end through the sheave-hole at the head of the topgallant mast round its own hauling part. Now put a trustworthy racking on both parts of the mast-rope just above the lower sheave-hole, and make a small tripping line fast to the heel of the mast, to guide it up clear when swaying it aloft.

If the lower and topsail yards are aloft, the topgallant mast will be easier sent up abaft the yards.

All being now ready, sway away the mast and point its end through the topmast cross-trees, and when the head of the royal mast comes above the topgallant cap a couple of feet, hold on the mast-rope and prepare to place the rigging over the masthead.

Firstly, put over the masthead a good grummet that has previously been fitted tight over the mast on deck. (This grummet is to prevent the eyes of the rigging slipping down over the hounds of the topgallant mast.) Next place over the mast the fore and aft topgallant stay, then the starboard pair of shrouds, then the port pair, and if the topgallant backstays are fitted in pairs, firstly the starboard pair, and then the port, and lastly the lift-strop.

Then commence with the royal rigging, grummet first, then the royal stay, next the backstays, and lastly the lift-strop. When all is secured over the masthead, let a couple of men go in the top to light up the rigging as the mast goes aloft. Sway away the mast a few feet higher, then belay the mast-rope, and double it. When the end of the mast-rope is hauled taut from the racking and well hitched to the cap, cast

off the racking on the mast-rope and sway away till the hounds of the royal mast come above the cap. Set all the rigging tight down on the hounds with a good wooden mallet, then heave away the mast-rope till the hounds of the topgallant mast come above the cap, and set the rigging tight down in its proper place. Then heave away and fid the mast.

When setting up the rigging a man ought to be sent aloft at the topgallant masthead to harden the eyes of the rigging well home with a mallet.

Many vessels that are fitted with wire rigging have either copper or galvanized iron funnels to fit over the masts in the wake of the topgallant and royal rigging. These funnels are to be most highly recommended, for the following weighty reasons:—

They prevent the small wire rigging cutting its way into the mast, which is a most serious objection, and ought to be strictly guarded against. They facilitate sending the mast up and down, the rigging being always ready at the topmast-head to receive the mast when changing masts.

When staying the topgallant and royal mast, set up the fore and aft stays first, the backstays next, and the rigging or shrouds last.

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## SECTION XIII.

## RIGGING AND SENDING ALOFT TOPSAIL YARDS.

Say the yard is on deck on the starboard side, port yard-arm forward; raise it on two chocks and commence work thus, concluding the iron bands, &c., are all in their places on the yard.

Fit the Flemish footropes on the yard, as described in fitting the lower yards. Also the footropes themselves must be fit at the yard-arms with two feet of chain, the same as the lower yard footropes; but not the inner end of the footropes, they must be fit long enough to reach at least eight feet beyond the centre of the yard, from the opposite yard-arm, as they have to be passed abaft the topmast, before seizing them on to the jackstay, after the yard is aloft. Shackle each footrope to the yard-arm; splice round them two or more stirrups on each footrope, as many as are fitted. Then take a temporary turn of the footrope to the sling-band of the yard.

Topsail-lifts are fitted to shackle on the topsail yard at the lift-band, and the other end of the lift has a thimble and lanyard in it. Now

shackle on the lifts to the yard-arm, and take a loose turn with the lanyard end to the slings of the yard.

Reeve the braces, pass them outside of all the backstays and topmast rigging, and shackle the brace pennants temporary on the foremast-shroud of the topmast rigging above the top.

Reeve the yardrope through the sheave at the topmast-head, down and through a top-block lashed a little outside the sling-band on the port yard-arm, and up again to the masthead, making the standing part fast over the eyes of the topmast rigging.

Next take a good line aloft, and reeve it through a block hooked on the topmast cap, overhaul it down on deck before all, and bend it on to the port topsail yard-arm; this topping rope will help the yard rope in keeping the yard well over-end as it goes aloft.

Take the yard rope to a good double winch and heave away, at the same time keeping a good weight on the topping rope.

When the yard is well over-end, and just before it is clear of the deck, bend a good line on to the lower yard-arm; this line, if kept taut forward, and eased away as the yard goes aloft, will keep it clear of the lower yard, and the rim of the top. Brace the lower yard by on the starboard brace, to keep the lower yard clear of the topsail yard.

When the yard-arm comes above the top, hold it there for a few minutes, and shackle on the port lift and brace, and heave away; as soon as the slings of the topsail yard clears the collar of the fore and aft lower stay, slack gently away the topping-rope, and let the yard square a little, so that the upper yard-arm will pass under the topmast stay; send a man aloft with the port lift and make it fast. When you are doing this a couple of hands can jump down on the lower yard and shackle on the starboard brace pennant. After the pennant is shackled on, let go altogether of the topping-rope, and let the yard well square itself. Heave away the yard rope till it is high enough to get the starboard lift fast. When this is done, lower away the yard rope, and parrel the yard. After the yard is parrelled, slack away the yard rope, till the lifts take the weight off the yard, steady tight the braces, unreeve the yard rope, and reeve the topsail halyards, which are generally fit with chain pennants before the mast, and rove thus:—A powerful iron block is shackled on the top of the sling-band. The topsail-tie, or pennant, is firstly shackled on to the topmast trestle-trees, the end taken down on the topsail yard, rove through the iron block on the yard, up through the sheave-hole at the topmast-head, and brought down as far as the top, abaft all; then a large three-fold

or four-fold iron-bound block is shackled on this end, and a stout fall rove through this block and a corresponding block hooked on deck; this gear constituting the topsail halyards.

NOTE.—Topsail and topgallant halyards are in many modern ships led to stationary winches, placed amidships abaft the mast; these work well in practice for both hoisting and lowering, and are a saving of much labour.

With a little modification the lower topsail yard is fitted and sent aloft in the same manner, with the exception that lower topsail lifts are sometimes fitted on the yards, about two-thirds the distance from the slings to the yard-arm. In vessels so fitted an iron band is placed for their reception on the yard.

But most vessels dispense with lower topsail lifts altogether, making the topsail downhauls act in their stead.

The topsail downhaul for the upper yard is first rove through a quarter block on the upper topsail yard, then through a yard-arm block, down through a block on the lower topsail yard-arm, and taken up and shackled or clip-hooked on to an eye-bolt at the extreme end of the upper topsail yard-arm.

Small vessels sometimes reeve the downhaul first through a block hooked on the rim of the top, up through a block on the upper topsail yard, and shackled on the extreme end of the lower topsail yard-arm. This is called a single downhaul.

Lower topsail yards are fitted with a truss, to keep them well clear of the lee rigging when braced up, and are supported from below by an iron standard, which works in a socket secured on the fore part of the heel of the topmast, or else in the top.

The lower topsail clewline-blocks are well out upon the yard, for when the sail is clewed up the clew cringle comes little more than half-way in along the yard.

Topsail sheets are of stout round chain, but it is customary on long voyages to stopper the clews of the lower topsails to the yards, in the trade winds, and slack up the sheets. Yet this cannot be recommended, for if the vessel got hove on her beam ends by a heavy tropical squall, she would probably be dismasted or turn over before there was time to unstopper the clews.

Fore and main topsail braces are generally fitted with a whip and pennant, thus:—A chain or wire pennant, from 2 to 3 fathoms in length, is shackled on to the yard, with a single block shackled on the other end. Through this block is rove a rope pennant. One end of the pennant is secured to the topmast-head; on the other end of the pennant is spliced a whip-block, through which a whip is rove. One end of the whip is secured to a bumpkin; the other part of the whip

is led through a leading-block on the bumpkin through a fairlead in the bulwarks, alongside of the lower brace leading-blocks.

Mizzen topsail braces are led forward. They are fitted as a single whip from the chain pennant.

## RIGGING AND SENDING ALOFT TOPGALLANT YARDS.

The topgallant yards have iron bands fitted on the yard-arms to shackle on the lifts and braces. Heavy yards have also three iron bands in the midship part of the yard, one for the halyards, and the other two, one on each side of the midship band, have eye-bolts clunk or thorough-welded in the lower part of the band, to hook on the quarter-blocks. These quarter-blocks are double blocks, one sheave being used for the royal sheet, the other for the topgallant clewline.

We will presume the yard is lying on the port side of the vessel, with the starboard yard-arm forward on deck.

Splice in the footropes as described for a topsail yard; also splice thimbles in the end of the lifts or clip-hooks, according to fancy. These lifts, if rope, must be long enough when the topgallant yard is down on the cap to reach from the yard-arm up to the topgallant masthead (where it is rove through a thimble), and down to the topmast cross-trees, where it is made fast.

Wire lifts are almost always lashed at masthead. Some seamen fit the lifts to set up with a lanyard to the topgallant masthead, but it is far better for the lifts to lead down to the cross-trees, as it saves you mastheading the yard, if you require them sent down in bad weather at sea, where it is anything but pleasant to have a large topgallant yard swinging about at the masthead whilst a seaman is casting off the lower lift; but heavy topgallant yards will always be fitted with wire lifts, which are shackled or lashed at the masthead.

Whilst the lifts and footropes are being fitted, send hands aloft, and reeve a good stout rope through the sheave-hole in the topgallant masthead, for a yard-rope, and overhaul it down on deck. Hitch this securely to the halyard shackle on the midship band of the topgallant yard, lay the bight of it tight along the yard, and put a good quarter-stop round both yard-rope and yard, about 2 feet from the midship band on the starboard side, so that the port yard-arm is much the heaviest, whilst swaying the yard aloft; also put a stop round the yard-arm, to keep the yard well over-end. If you have fitted the gaskets on the yard, these will act well for both quarter and yard-arm stops.

After a loose turn is taken with the inner ends of the footropes and lifts round the yard-rope near the midship band, all is ready for swaying away the yard. If it is a heavy yard it will have to be hove up with the capstan.

As the yard goes up, make a tripping line fast to the lower yard-arm, to trip it out clear of anything it may foul whilst going aloft.

We will presume the braces and parral are aloft, all ready to secure to the yard, and that it is a tub parral of modern construction.* Two men aloft are all that is necessary to cross the yard. When the upper yard-arm comes above the cross-trees, avast heaving. One of the men aloft then passes the starboard brace round outside the starboard topgallant rigging, shackles it on the yard, observing that the brace has no turns in it, and casts off the yard-arm stop.

The other man casts off the lift from the yard-rope, takes the end aloft, and reeves it through the thimble at the masthead, and brings the end down in the cross-trees, taking in the slack a little as the yard goes aloft, or lashes it through the eye if fitted that way.

Then again sway away the yard. When the lower yard-arm comes on a level with the upper topsail yard, take the port brace and shackle it on; cast off the lower lift, and carry the end aloft, and reeve it through the lift-strop at the masthead, or shackle it on, as the case may be. When the yard is well up ease off the quarter-stop, and the yard will square itself; take in the slack of the lifts, and when these are fast, lower away the yard-rope, parral the yard, and steady tight the braces. The yard is then crossed. Pass the footropes abaft the topgallant-mast, and seize them on in their respective places.

Then reeve the topgallant halyards.

Topgallant halyards are generally fitted thus:—A chain pennant is shackled on to the sling-band of the topgallant yard; it is then taken up and rove through the sheave-hole in the masthead, and leads down abaft the mast, and shackles on to an iron-bound double block. A corresponding block is hooked on the after part of the top, and a stout fall rove in these blocks, the hauling part of which leads on deck. This gear constitutes the topgallant halyards.

Very heavy topgallant-yards have a chain-runner abaft the mast, to help the purchase-fall; the end of the chain-runner shackles on in the top close to the lower halyard block.

* These tub parrals are not an unmixed advantage, especially when, as is most usual, they are secured to the *yard*, as they are very much in the way when sending yards up or down. If proper tubs are on the mast, then they are all right; and as the yard stands well away from the mast, it can be braced very sharp up without chafing the lee rigging; but parrals secured to the yard which are common nowadays, are very much in the way.

Main and fore topgallant braces lead aft, and are fitted with a whip and wire pennant, one end of the pennant being shackled on the yard on the other end is shackled a whip-block. The standing part of the whip makes fast to the collar of the topmast-stay, where also a leading block is fitted to receive the hauling part of the whip, to keep it down clear of the foot of the topgallant sail; it is then rove through another block hooked on to the topmast trestle-trees, and leads down on deck.

Mizzen topgallant braces are led forward, and secured to the maintop-mast cross-trees with whip and pennant.

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## SECTION XIV

# SENDING OUT THE JIBBOOM.

Many large ships now-a-days carry no flying jibboom at all, putting extra canvas in the outer and inner jib to make up the deficiency. In almost all cases the boom is one spar, the separate flying boom being hardly ever seen. There are also many new ships whose jibboom and bowsprit are formed out of a single spar of iron or steel.

In this description it is assumed that the vessel carries no flying boom, and that the outer and inner jibboom is one spar, with an independent bowsprit.

Place the jibboom on the topgallant forecastle, and with a single rope and top-block secured to the bowsprit cap, heave it out till its end is pointed through the cap a couple of feet, then secure it there and double the heel-rope.

Now take the inner guy band (which is fitted with three eye-bolts in it, one for each guy on the sides, and the other right beneath it for the martingale stay to shackle on to), and place the band over the boom end; then take the outer guy band and place it over the boom end (it is fitted precisely in the same way as the inner band); then shackle on the outer guys and flying martingale stay, and beat the band hard down on the hounds of the boom.

Whilst this is being done hands on the topgallant forecastle should reeve both inner and outer jib-stays through all the hanks required for each jib, and stop them together on each stay high enough to clear the boom. When this is executed reeve the outer jib-stay through the hole in the boom, also the topgallant and royal stays, overhauling enough of them through to allow the boom to go out into its place, with the ends

of the fore and aft stays made temporarily fast about the outer end of the bowsprit.

The outer ends of the footropes are generally shackled on along with the guys, or a small piece of chain with a large link is fitted on each footrope to go over the eye-bolt before shackling on the guy.

Make fast both pairs of jib-halyards to the outer end of the jib-boom, and station hands by them to ease them away as the boom goes out. This will help to support the boom and ease the weight off the heel-strop.

Have a good heel-strop round the bowsprit and heel of the boom, to prevent it topping up. All being ready, heave away the boom again, and when the hounds of the inner boom come outside the cap, shackle on the inner guys and martingale-stay, and reeve the inner jib-stay through the boom, after having secured the outer end of the inner jib-boom footropes to the boom band. Heave away the boom, tending well the jib-halyards and heel-strop till the tenon of the boom will enter the chock on the bowsprit. Then belay the heel-ropes and heave the heel close down to the top of the bowsprit by the heel-strop before mentioned, and when the tenon is in its place, clamp it there with the heel-iron, and let go all the gear.

Whilst unreeving the heel-ropes, &c., set hands to turn in thimbles, or hearts, as they may be fitted, into the ends of the fore and aft stays, ready to set them up to their respective eye-bolts. Parcel each stay well in the wake of where it passes through the boom, and also in the wake of the martingale. Other hands can be seizing on the footropes and getting tackles ready to set up the gear.

Firstly, set up the martingale back-ropes, which will give the boom the required stave; then clap on the guys; and lastly, set up the fore and aft stays.

The jibboom should, whenever possible, be rigged in when entering crowded rivers or docks. A great many American vessels nowadays have their jibbooms rigged with a powerful gooseneck at their inner end, and the upper part of the bowsprit cap forms a clamp iron for the jibboom. Vessels so fitted in harbour unclamp the cap and top the jib-boom right over-end; but in large vessels we think this plan is not to be recommended, one of the chief reasons being, a heavy spar, 60 or 70 feet in length, standing right over-end, and only temporarily secured in that position, is dangerous in the extreme in case of a harbour collision.

## SECTION XV.

# RIGGING GAFFS AND BOOMS.

There are several methods of fitting a gaff to the mast; the old method with jaws to work up and down the mast, and large wooden hoops securing the luff of the sail, is practically speaking now done away with, except in small vessels. The usual method now adopted in fitting a gaff, is with a strong iron gooseneck on the inner end, fitting into an iron traveller that works up and down the mast upon a powerful guide rail.

This method, especially with iron masts, is to be preferred to any other, being both neat, strong, and easily worked.

The guide rail is formed by a common bulb-iron or rail plate being spiked upon the after part of the mast. (*See sectional view of guide rail and hanks, Plates 57, 58, 59*).

The hanks are made of galvanized iron, to prevent them rusting the sail. Some of these hanks are stronger than others, and have an eye on each side of them, on which the brail blocks are seized.

*Plates 57, 58, 59.*

The peak halyards have on their outer end a stout ring, through which is rove a chain-span near the outer part of the gaff; then rove through an iron block that is shackled on the lower mast-head, and led down to the deck. These halyards (or peak tie) are worked by a luff-tackle purchase on the lower end, and are made of round chain.

*Plate No. 60.*

The throat halyards are shackled to the inner end of the gaff, and led up through an eye-block shackled on an eye-bolt in a chock on the after lower trestle-trees; they, like the peak halyards, are composed of round chain, and are worked with a luff-tackle purchase on their lower end.

If a trysail or spanker is so fitted, three men can with the greatest ease take in the largest of fore and aft sails in a couple of minutes, by simply lowering away the throat halyards (keeping the peak halyards

*Plate No. 61.*

fast,—*mind this*) and taking in the slack of the vangs, when the jaws of the gaff will run close down on the boom, and the gaff will assume a vertical position close to the mast, which will cause the head of the sail to run down the gaff and it can either be stowed or reefed as the occasion requires.

The head of the sail, when fitted in this manner, runs out and in upon a traveller on the gaff, very similar to the luff, and is worked by a head outhaul and inhaul. The sail requires no brails or foot outhaul, as the sheet cringle of the sail is lashed permanently at the boom end; yet many vessels use a foot outhaul for the sake of letting the clew of the sail come in to the mast in harbour, as it looks neater than if stowed with the clew at the boom end.

When wanting to send the gaff aloft in its place, reeve the peak and throat halyards, and also the head outhaul, and secure them to the ends of the gaff in their respective places; pull up the throat halyards, and ship the gooseneck on the inner end of the gaff in the traveller; then shackle on the vangs, and pull up the peak halyards till the gaff is well above the boom, and bend the sail if necessary.

Many large sailing ships have their gaffs fitted with a gooseneck, that ships into the spider-band on the after part of the lowermast, the peak of the gaff being secured aloft in its proper place by a chain-pennant from the lowermast head, the spanker boom being hung by another chain-pennant shackled on to the gaff. In this description of rig the pennant supporting the gaff requires to be extra strong, as it has the weight of both boom and gaff to contend with combined. The reason why vessels adopt this method in rigging the gaff and boom is, it does away with both topping lifts; the boom always remains in the required position for setting the sail after it has been taken in; it saves the sail getting chafed by the topping lifts; and last, but far from least, the boom requires no special attention when tacking ship in narrow waters.

This rig is termed a standing gaff. Yet remember gaffs and booms so fitted have their weak points, one of the worst features being in reefing, or taking in the spanker when blowing hard, and it is then that the first method described shows itself prominently to great advantage.

## SECTION XVI.

# MAKING AND SHORTENING SAIL.

### SETTING TOPSAILS.

If the clews of the upper topsails are shackled or lashed on the lower topsail-yard, there is really nothing to do in setting the sail but to tend the braces and sway away the halyards till the leaches are taut, then point the yard, and steady tight the lee braces.

Upper topsails are very often fitted with short sheets, and are much handier this way, especially in stowing. In this case they are sheeted home before hoisting.

Upper topsails are often set first when getting under weigh from a crowded anchorage.

When setting a lower topsail in a strong wind, overhaul the lee gear well, and haul the lee-sheet home first, then the weather-sheet, point the yard, and steady tight the braces.

When pointing the yards, if the vessel is going by the wind, keep the weather topsail braces a little more in than the lower braces, so that the topsail yards are a shade squarer than the lower yard.*

### SETTING TOPGALLANT SAILS AND ROYALS.

Say you have been under topsails, a strong breeze still blowing, and you are about to set the topgallant sails.

Lay the yard by the braces as required, a little more square than the topsail-yard. See the topgallant clewlines, buntlines, sheets, and halyards all clear.

When the sail is loose, overhaul well the lee buntlines, and run the lee sheet nearly home ; then the weather sheet chock out, and then lee sheet again. Let go the lee brace, stand by the weather brace, and hoist away the sail until the leaches are well taut. Then steady tight the lee brace and coil the gear all clear for running on the pins.

If a heavy sea is running, and the ship labouring, it will be necessary to tend both braces when hoisting the yard, to prevent it swaying violently about.

Royals and skysails are set in similar manner to the above.

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* This is sea fashion everywhere ; but scientific experiment seems to prove that (on a wind) the sharper a vessel's yards can be got the better for both speed and weatherliness ; and some very experienced sailing shipmasters recommend getting the lower yards as sharp as possible, and trimming all the upper yards in line with them ; of course only in moderate weather.

## SETTING THE COURSES.

Rouse well tight the lifts, send hands aloft, and loose the sail. When casting the gaskets adrift order them to be made up in snug hanks and hove before the sail, keeping them close up to the jack-stay. If this is not attended to, the gaskets will probably fly about and get jammed in some of the running-gear blocks when setting the sail.

Man the lee sheet, let the men on the yard overhaul well the lee buntlines and lee leachlines, and haul the sheet well aft. When all ready for boarding the tack, give the vessel a luff up, if by the wind, with the helm, and rouse well down the tack. After it is well secured and made fast, while the ship is shivering in the wind, jump over to leeward and rouse the sheet close aft, then haul well taut the bowline, and coil all gear snugly up ready for running.

Mind that the buntlines and leachlines are well overhauled, so that they will not girt the sail; and if it is blowing strong, put a preventer tack and sheet on.

## SETTING THE JIB.

See the head downhaul all clear for running, that the tack is well fast, and that the hanks, especially the head ones, are securely seized on. Have the halyards in a leading-block on deck, so that it can be run smartly up. Then loose the sail and steady the sheet aft. When this is fast, let go the downhaul and run the sail smartly up. Then clap on the sheet again and rouse it well aft.*

## SETTING STAYSAILS.

These sails are set precisely the same way as the jib, therefore no description is necessary, only let this caution be used in setting light and lofty staysails, namely, when the sheet is steadied taut, before letting go the downhaul, mind and hitch it securely over the pin, where it is made fast, as such staysails generally are fitted with a single sheet, and if this by any means whilst setting the sail gets adrift, it is dangerous to go near it, and a split sail is often the result.

The writer has repeatedly seen men injured by trying to get the slack of a lofty staysail sheet in when it has not been hauled down far enough before setting the sail. These single sheets should always be led through a cleat on the bulwark stanchions before being belayed on a pin, for when the sheet is flicking about the men can gather in the

* The sheet will often be found, as the sail goes up, to be too far aft. If so, it will have to be eased until the sail will hoist.

slack abaft the cleat without exposing themselves to the danger of an ugly blow.

A large jib or staysail should never be left shaking heavily, as it puts a great strain on the masthead, and may damage the spar. In fact, if the sheet gets adrift after the halyards are belayed, the most prudent thing to do is to down sail at once and secure the sheet, or else trip it up.

### SETTING THE SPANKER.

Top the boom up a couple of feet higher than you require it when the sail is trimmed, overhaul well the lee topping lift, and unhook it to prevent the lift chafing the sail. Ease the sheet a little, and steady moderately taut the lee guy. Let go the brails and run the foot outhaul tight out, and belay it. Then let go the head downhaul, and pull the head taut out by the head outhaul, trimming the sheet and weather vang as required. Mind the weather vang is slacked well off when hauling the head of the sail out, or you will carry away the gaff or break the vang fall. The lee vang should be kept slack during the whole time you are setting the sail, and only kept in hand to prevent the gaff knocking about.

In conclusion, I may add, an officer wants to be very vigilant in making sail, and not to be going about letting go ropes, &c., himself, but keep his eyes well above his head, and see that the canvas is well clear of the running gear blocks; also he must see the crew go about their duty with smartness and alacrity, and when giving orders to any of the men who are aloft see that he is answered *immediately*, and take care all the slack ropes are hauled well tight when coiling up, and that all the gear is ready at a moment's notice for taking in the sails.

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## SHORTENING SAIL.

There is an old saying amongst seamen that any fool can make sail, but it requires a skilful sailor to take it in, and we must admit there is much truth in that old adage.

When a vessel is by the wind, or close-hauled, it is comparatively easy to shorten sail to what it is when running free.

There is less weight of wind to contend with when the ship is close-hauled than when running before it, and a sail in such cases can be more easily spilled and shaken, without the danger of splitting it; whereas with a vessel scudding with the wind aft or on the quarter, and increasing to such an extent as to make it necessary to shorten

sail, every precaution must be taken to prevent losing the sail, or worse, springing a yard.

To take in the mainsail in a hard gale with the wind quarterly, first haul well taut the main lifts, get plenty of hands on them, and take in every inch of the lift falls you can get. See all your gear clear in the fairleaders, viz., clew garnets, leachlines and buntlines, then gently ease off the lee sheet, and take in all you can get of the buntlines and lee leachlines; now slack away the sheet and haul up. When the clew garnet is chock up, and you have got all you can of the lee and weather buntlines, ease away the main tack, do not let it go rip, but ease it gently away at first, man the weather leachline, buntline, and clew garnet, and haul all the gear close up.*

But perhaps the more usual method is to haul up the weather clew first, in which case the sheet is eased off as far as possible without shaking the sail, and as much as possible of the lee-gear got in. A few hands are now left at the lee buntlines, and the weather-gear manned; ease gently away the tack, and clew up to windward; when the weather-gear is close up, man the lee-gear again, and up with the lee clew, hauling all buntlines and leachlines snug up.

If you have the main topsail set, it is wise before you start the main tack to put a good tackle on the weather main yard-arm, and bowse it well taut to prevent springing the main-yard; for the want of this tackle being placed as described, many a vessel has sprung her main yard, especially so when the main tack by accident has taken charge and been let go by the run. This is not so important with double topsails as it was when whole topsails were carried.

When a seaman knows enough to get the main course safely hauled up in a gale of wind, he can always manage a lower topsail, for the latter named sail will come in in the worst of weather, if carefully clewed up, *weather clew first*, then haul well taut the buntlines, or spilling lines, and lastly start the lee clew, snugging the buntlines close up.

When a lower topsail comes in, if running, the course has most likely been taken in previously, in which case it will always be possible

* Main buntlines should be rove as follows:—In the middle band at the top of each buntline cloth, have *lignum vitæ* bull's-eyes worked in with grummet strops sewn into the sail; the legs of the buntlines are then rove down before all, through these bull's-eyes, and clinched to the foot cringles on the aft side of the sail.

Leachlines should be rove spilling line fashion, that is, down before all through a similar bull's-eye in the leach, and up abaft all. With gear rove thus, a main or four course can be so snugged up that it can at any rate be *secured* in any weather. A brand new mainsail wet through, in a heavy gale, *cannot* be furled snugly in a large vessel; it is an impossibility; and gear led this way is thus *very* serviceable.

Upper topsails are not always easily stowed, the sail is liable to flap *back*, over the yard, and many a man has been knocked overboard by this. When heavy weather is expected, the upper topsail buntlines should be rove as spilling lines, *i.e.*, rove through a bull's-eye worked into the foot of the sail, brought up abaft, and made fast to the yard; when the sail has been got hold of they can be slacked up if necessary.

to point the yard to the wind, and spill the sale, which will enable it to be clewed up much better, and be more easily furled.

If you chance to be fitted with Cunningham's patent topsails, where the bonnets come some distance below the close reef band, ease off the topsail sheets, and roll the sail up as far as it will go, then clew up the same way as described for a lower topsail; but in this case, mind the sail is rolled up as far as the bonnet will admit of it doing before pointing the yard to the wind. But I may remark these sails are very unhandy in a heavy ship, and their use is almost entirely confined to small vessels.

In taking in royals and topgallant sails, first see the yard is well down upon the lifts, then haul in the weather-brace to spill the sail, and man the lee clewline and buntlines, ease away the lee sheet, and clew up; after having got as much of the weather buntlines as possible, clew up to windward, and haul all the gear close up before sending the hands on the yard to stow the sail; also see the braces are well taut and the yard pointed to spill the sail as much as possible. Great tact can be displayed by an officer in laying the yard when taking in these sails. When close hauled, it is as well to let run the lee sheet and halyards, at the same time round in the weather-brace, let go the weather-sheet, up with the weather-gear, and haul the buntlines snug up.*

To take in a trysail when blowing hard, ease off a little of the sheet (not enough to shake the sail), then let go the head outhaul, man the downhaul, and pull the head of the sail close down to the gooseneck or jaws of the gaff, and steady tight the weather-vang.

Now well man the lee brails, ease away the sheet, and brail up *to leeward*, merely gathering in the slack of the weather brails. When the lee brails are close up, then haul taut the weather brails, for if you put any weight on the weather brails before the lee ones are chock up, a bag of wind will form in the sail, and you will find it impossible to get the sail in without splitting it.

The days of the single jib are amongst things of the past. This sail was usually carried till the second reef came in, and at such times it used often to take an hour or more to furl it in a heavy ship.

But even in these days of outer and inner jibs, care must be exercised when, after hanging on to them too long in a strong gale, it becomes necessary to take them in.

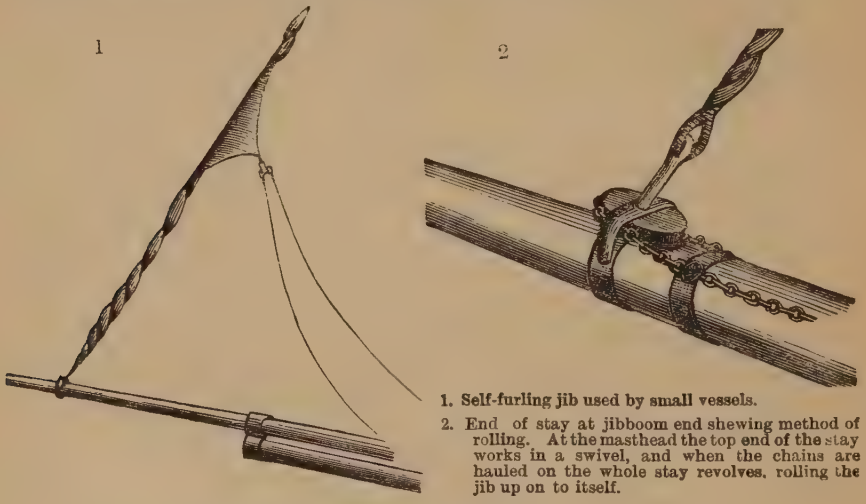
* It is sometimes a matter of difficulty to get a yard down on the lifts; this *must* be done, however, by some means, such as hauling on the braces and lighting up the halyards, and jumping down the parrel. Never send hands out on a yard to furl a sail until it is down on the lifts; if you do it may come down with a jump, and jerk someone off.

Always attend to hails from aloft at night. A buntline lizard may be carried away, and the buntline hauled up too high, or the yard may want bracing more by. Attention may prevent loss of life by falling from aloft.

As a rule the outer jib will generally be taken in before the weather gets very bad. To take in the inner jib, first take the precaution to have the downhaul led along the forecastle, down on the main deck. If she is diving into a strong head sea, and shipping water over the forecastle head, get the downhaul over a cleat or pin, so that you hold every inch you get of it, station your men on the downhaul, and in this form it acts the part of a life line, and will prevent the men getting washed off their legs whilst hauling the sail down.

Now let go the halyards by the run; at the same time ease the sheet off a bit, but not too much; down with the sail as quick as possible, and when the sail is well down slack the sheet broad off, and haul the head snug down on the boom.

If there is a strong gale blowing, and you are not pinched for sea room, up with the helm and keep her away before the wind. The crew will then be enabled to hand the jib in five minutes; but if the vessel's position will not admit of her being kept away, the men must then lay out on the boom and pick it up the best way they can.




1. Self-furling jib used by small vessels.
2. End of stay at jibboom end shewing method of rolling. At the masthead the top end of the stay works in a swivel, and when the chains are hauled on the whole stay revolves, rolling the jib up on to itself.

*Plate No. 62.*

But here I may remark that more seamen have lost their lives in stowing the jib than in stowing all the rest of a ship's sails put together, and often has life been sacrificed in stowing this sail when really there was no necessity for doing so.*

* There is an old-fashioned fitting to a jib, now seldom seen, called a gab rope, which is of great assistance in furling the sail. A cringle is worked on the footrope of the sail at a distance from the tack equal to the length of the boom outside the bowsprit cap. A line is clinched to this cringle, rove through a block on the bowsprit cap, and led inboard. When the sail is down the weather-sheet is hauled over, and this gab rope hauled *taut*. This brings the foot of the sail tight along the boom, and makes the furling an easier job.

If the downhaul of the jib is taken hold of carelessly, and no turn over a pin taken with it on the main deck, if the vessel ships a heavy sea over her bows, away go all the men off their feet when perhaps the sail is half down, and the sail gets battered about and probably split. (Officers who are careless in these small matters cost their owners many a bill for canvas which might have been spared, and instead of being worth their pay, are often a source of expense to their employer.) When taking in any jib or staysail, be careful to see the halyards are laid down all clear for running, and see whilst they are so no kinks run aloft. If the downhaul of a jib should accidentally break whilst hauling it down, clap on the halyards immediately and reset the sail, up with a coil of rope, take it out on the jibboom, and reeve it through the downhaul block, bring it inboard, and send a hand aloft with the end, and make a bowline knot with it round the jib-stay. Let it run down to the head of the jib, and haul down and take in the jib as before directed. Do not take the old downhaul, as it will be too short.

A staysail is taken in in the same manner as a jib, but comes in much handier. The main topmast staysail in many vessels is carried till the double reef comes in, but it is a sail very easily handled, generally running nearly down of itself as soon as the halyards are let go.

But it must be always borne in mind, if the fore and aft sails have been carried too long, that to wipe the ship off before the wind for a few minutes, and take them in, is a very easy matter, that can mostly be put in practice *if the master likes;* and really, on a long voyage, the few minutes' detention that may occur through this manœuvre, that may only happen two or three times during the passage, will not be felt by the ship as to time, and may be the means of saving you a heap of new canvas, to say nothing of the risk to life and limb.

The old Indiaman's jibboom end used to be on a level with the foretop; but remember, our clippers of to-day have their jibbooms with very little stave in them, and consequently are doubly dangerous to go out on to what the old booms were.

There is considerable divergence of opinion amongst seamen on taking in square sails. Some will advocate clewing up to windward and hauling all the weather gear close up before starting the lee sheet; others will recommend an opposite course. In *furling* a clewed-up sail, however, there is only one opinion: the weather yard-arm is first furled. In the well-known quotation from Falconer's "Shipwreck"—

"He who strives the tempest to disarm
Will never first embrail the lee yard-arm."

The young seaman has a good "Aid to Memory" of this important rule.

NOTE.—In furling a royal with a green hand, send him to leeward. The sail flaps about less there than to windward, and he should be given the position of least danger.

You must not in squally weather trust always to an old sea rhyme, which says :—

> "When the wind comes before the rain
> You may hoist your topsails up again ;
> But if the rain comes before the wind
> Your topsail halyards you must mind."

This doggerel rhyme only applies to ordinary squalls, mostly experienced about the tropics, and is not applicable to the S.W. monsoon in the Indian Ocean, Bay of Bengal, or squalls in the North Atlantic in winter time, and many other places too numerous to mention.

If you are carrying a strong press of sail, and the weather begins to turn squally, it is prudent to take in the royals and light staysails, as you will undoubtedly find, if a strong squall strikes the vessel, the topgallant sails and flying jib are quite as much as the watch can handle with safety, unless you are doubly well manned, which in these days is seldom the case.

It is far easier to loose and reset a royal, than it is to have to send down perhaps a sprung royal yard, or a split sail, and bend another—not to speak of the expense, or the risk of twisting the topgallant cap off the mast, or springing the masthead.

If after the topgallant sails are handed, the weather becomes rapidly worse, the order has been given, *Call all hands, shorten sail*, and you perceive a heavy squall is about to strike the vessel before the watch below can be on deck, then up with the weather clew of the mainsail, stand by the topsail halyards, and before it strikes the vessel down with the upper topsails, and give her a wipe off before the wind.

When she is before the wind, let the jib and main topmast staysail run down, then bring her gently to the wind ; by that time all hands will be on deck, and you can shorten her down to what is necessary, according to the state of the weather.

If you find the ship will not go off when the helm is hard a-weather, ease off a little of the main and spanker sheets, and shiver the after yards by easing the lee braces ; a very little will do it, and your vessel then will fly off before the wind. Be careful in bringing her too, and not let her come with what seamen term a "fullock ;" if you do, and the squall is exceptionally heavy, you stand a good chance of springing some of the topsail or lower yards, or perchance losing a topmast.

Squally weather, about the equator especially, is very dangerous weather to carry a very heavy press of sail in, as the squalls are of such unequal strength. One comes that looks a heavy squall, which may turn out to have very little wind in it ; where the next, which

looks to have little or no wind in it, may have energy enough to put the topgallant masts over the side. About the tropics these kinds of squalls are of common occurrence, so it behoves a seaman to be very careful in these latitudes, and not carry too great a press of sail, and not be led astray by the comparative lull between squalls. A good sign to go by is its density; if you can see through a squall, there is seldom much in it; but if too dense to see through it, mistrust it at once.

In high latitudes, generally speaking, squalls are not of such unequal strength as they are found in navigating the tropics, and therefore more canvas may be carried; yet as there are exceptions to every rule, so there is in this. In the latter part of the autumn, and the beginning of spring time, in high latitudes you will occasionally experience heavy squalls of unequal strength, very similar to tropical squalls.

When coasting along very high land in squally weather, it is best not to carry over great a press of sail, as the wind often rushes down the valleys in great force, when you are on a weather shore, or have an off-shore wind; in such cases, hand the royals, flying jib, and light staysails.*

When tacking in narrow waters with a large vessel, it is best to furl the mainsail and crossjack, and leave the leachlines and clew garnets well slack, so as not to hamper the yards when swinging them. The ship works much easier without these sails, and if you have to keep away hurriedly, or bear up for a vessel on the starboard tack, the ship will answer the weather helm much quicker without the two above-mentioned sails.

After having furled royals and topgallant sails, see the yards are properly pointed to the wind, by the braces, and haul all running gear taut belonging to them, for nothing looks so unseamanlike as to pass another vessel in bad weather, with all her ropes flying about, as if they really did not belong to her.

* In some places it is necessary to be *very* careful. For instance, if bound into Table Bay from the eastward, with a strong south-easter blowing, in coming along the high land the ship will at times be almost becalmed, whilst the next minute she may get a gust to which the topsail halyards will have to be let run.

## SECTION XVII.

# SAILING SHIPS GETTING UNDER WEIGH AND ANCHORING.

We will suppose, for sake of an illustration, that the vessel is riding to a single anchor in an open roadstead, that moderate weather prevails, and that she is about to get under weigh, with an off-shore wind.

Set one hand aft to cast off the relieving tackles, and oil all the wheel gear, whilst the carpenter is looking to the windlass, &c.

All being now ready, heave away the windlass. If it is a patent windlass, and the chain comes direct from it into the chain locker, a couple of hands must be sent below to coil the cable snugly in the lockers as it comes in. If it is one of the old-fashioned windlasses, then two hands range the chain on deck. When the cable is short, pawl the windlass, send hands aloft, and loose the topsails, courses, jib, and spanker. Masthead the upper topsails, and brace the afteryards sharp up on the tack you wish to cast the ship, and lay the foreyard a-box. Put the helm hard a-lee.

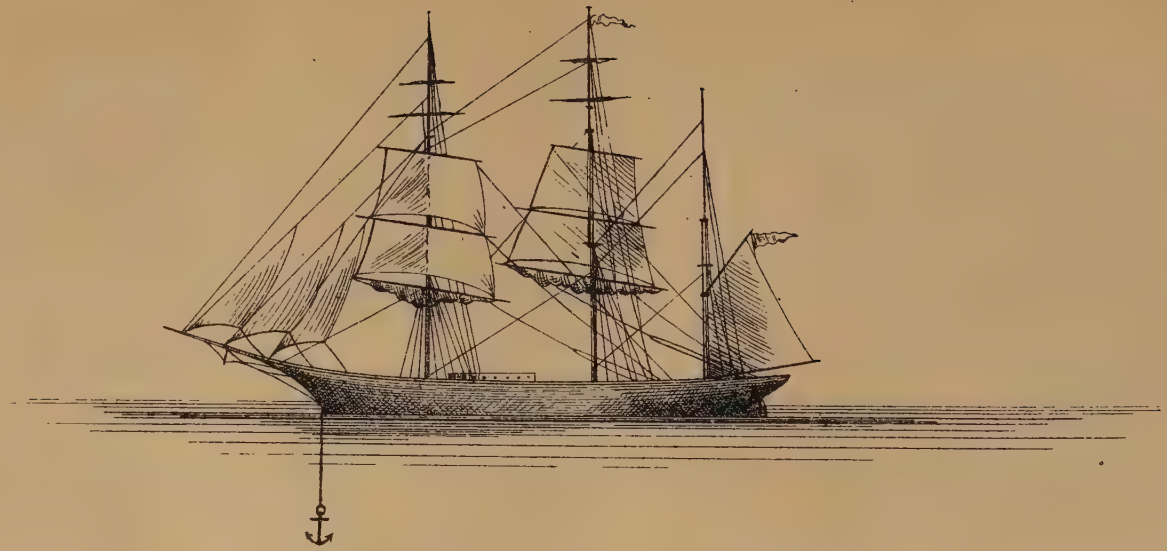
Now trip the anchor, and when she falls off so that the wind is a little on the bow, run up the jib and fore topmast staysail, keeping the sheets to windward. As soon as ever the afteryards fill, turn the foreyard round, brace it up, and let flow the jib sheets, hauling them over to leeward.

Directly she begins to gather headway, put the helm hard a-weather, and heave away the anchor whilst a few hands are setting the spanker. You then have the ship under command. As soon as the anchor is up, cat and fish it. Set the lower topsails and courses, then the topgallant sails and flying jib, and the other light sails as required.

If the roadstead is crowded with shipping, it is as well to keep the mainsail and crossjack hanging in the gear till you get out into open water; or if you are about to make a series of short boards, by all means keep the latter named sails furled, as the ship will work much easier without them.

If you are riding on a lee shore, and moderate weather prevails, the same evolution is carried out as described above, with the exception that as soon as the anchor is tripped all plain sail must be put on the ship as soon as possible, and the anchor hove close up and secured after the canvas is set.

But remember, no seaman can feel easy in his mind till the anchor is secured; yet many give themselves no end of trouble and anxiety by



CASTING FROM AN ANCHORAGE.

Anchor a-trip, head yards and jibs aback and boxing her off. Helm a-starboard for sternway and canting her head to starboard. When the after yards are well full fill the head yards, haul the head sheets over and shift the helm.

*Plate No. 63.*

crowding too much canvas on the ship before the anchor is hove up clear of the water, when there is often really *no necessity* for doing so; for you must recollect when the ship has good way through the water it is very often a difficult job to get the catblock hooked on the anchor. Many a smart seaman whilst doing this duty has been lost overboard and drowned; but this accident can always be avoided by making the seaman who goes on the anchor to hook the catblock on, sling himself in a bowline. At times, through the chain getting underneath the stock of the anchor, it is quite impossible to hook on the catblock until a hand goes down upon the anchor to guide the hook of the block through the ring of the anchor. Therefore, under such circumstances, the less way the ship has through the water the easier will this duty be accomplished.

Now let us assume you are lying in an open roadstead, and a heavy gale has commenced to set in upon a lee shore. Great danger attends picking up your anchor, so you have determined to slip it and stand out to sea.

Whip a reef in the fore and main courses as quickly as possible. Whilst this is being done, pass a good hawser out of the weather quarter chock, according to the tack on which you determine to cast the vessel, lead this hawser along the side outside the rigging, and hitch it securely to the cable chain just below the hawse-pipe.

When this spring is well fast, haul it tight aft; then belay it securely, and station a hand by it with an axe to cut it when ordered.

Now loose the lower topsails, inner jib, and spanker. The reefed courses are loose, hanging in the gear. Brace the yards up on the required tack, and sheet home the three lower topsails.

Now unshackle the cable, buoy the end, and see it is all clear for slipping.

Have handy tackles placed on the tacks and sheets of the courses, to enable the crew to set them smartly.

All being now ready, slip the cable. The ship will now settle astern, and heave a great strain on the quarter spring, which will cast the ship on the required tack.

As soon as ever she begins to cant, up with the inner jib and fore-topmast staysail, and when the topsails fill, cut the spring, keeping the helm amidships. Set the courses and spanker as quick as possible, and as soon as she begins to gather headway, meet her with the helm and bring her close to the wind.

This evolution is one of the most difficult tasks a seaman has to perform, especially if it blows hard and has come on very suddenly,

and it requires all the energy and resource he is master of to save his vessel from getting stranded.

In Madras Roads, during the hurricane season, and in similar places, all vessels should anchor with a spring on their cables, and their sails reefed, ready to slip at a moment's notice.

When a vessel is lying near you, and the tide is not very strong, the rule is to cast towards her, if the position of other vessels will admit of this being done, because in casting your vessel gathers stern-way, and increases the distance from the other vessel.

In acting on this advice, local surroundings must be taken into con sideration, viz., how you are situated in regard to other vessels lying near you, the set and rate of the tide, and lastly, the force of the wind. For say the wind was very light, with a very strong tide running, and a vessel was riding a short distance away from you, a little on either quarter, as the case may be, it would not be prudent to cast towards this vessel, for the tide in all probability, running so strong, would set you right athwart of her bows before you gathered *sternway.*

Under such circumstances I would trip my anchor and drop down till I was clear of the above-named vessel, tending her with the helm, and sheer her as required.

In getting under weigh from an anchorage, if moored with two anchors, with the wind abeam, or riding on a weather tide, pick the lee anchor up first.

No directions as to casting the vessel or making sail are necessary, as the moment the last anchor is tripped the vessel will run away before the wind, so you can place her in whatever position you think fit, and make sail as required.

It will be seen now that no hard and fast rules can be laid down for getting a vessel under weigh, but the master in command must first have a look around and see the conditions of weather and the lay of the land before taking action.

As a further illustration of what might happen, which we will accompany by a diagram of the movements in numerical order, let us imagine that a full rigged ship is anchored fairly close in-shore.

The wind is blowing towards the land at an angle of about 4 points to the lay of it, and on her inside quarter is a shoal or a rock, about 2 cables distant. We have mentioned a little way back that a square rigged vessel will gather sternway before getting any headway, so there is only one thing for it and that is to cast the vessel's head towards the danger and carry on astern until it can be cleared. This is not a difficult manœuvre, but requires judgment in the trim of the yards and prompt action when orders are given.

## GETTING UNDER WEIGH, WITH A SHOAL, AND, OR, ROCK ON THE INSIDE QUARTER. WIND AS PER ARROW.

As a final remark about getting under weigh in square rigged vessels.

If the wind is ahead, set those sails required on the fore, first, and so screen the sails on the main.

Setting square sails when well aback and the canvas pressing on masts and gear is not only awkward but requires more labour, and lends itself to chafe and possible tearing of canvas.

If the wind was off the land and the vessel's course is to be away from it. Heave up the anchor, heave it right up to the hawse-pipe. Two or three hands can hoist the jibs when the vessel's head has fallen off sufficiently to do so, without having the sheet blocks swinging around the fore-castle head and the crew's heads as well.

The same two or three hands can sheet home the lower topsails when the vessel is well off before the wind, for the weight of the chain sheets is of assistance. All this of course is subject to weather and traffic

The amount of canvas set depends upon weather conditions, but the lower top-sails should be sheeted home directly the anchor is tripped.

With the fore yards aback and the main and cross-jack yards squared not only will the vessel gather sternway but her stern will round up towards the wind, and when this combined action has stopped is the moment to square away the fore yards and put the helm hard a starboard for headway. Having the helm for sternway in the first instance is correct in theory but don't forget that the rudder was not built and fitted for receiving severe strains on the wrong side, so once again: use judgment as to how much and when to use it for sternway.

No. 4 shews the fore yards braced up on the port tack ready for the wind on that side, but it might happen that the rounding up into the wind had to be done quickly owing to the nearness of the land or the force of wind only light, in which case the main yards would be braced up first, to be followed by the fore yards. All judgment.

Supposing now that there were objections to casting the vessel's head towards the danger, viz., to port, and it was essential that she should be got under weigh on the port tack.

If the weather is fine and a moderate breeze only, then run a kedge anchor, with a good rope attached, from the port quarter out towards the port bow at any angle of about 4 points.

Get it well ahead and heave away on this at the same time that you are heaving up the anchor, and when the anchor is weighed continue heaving on the kedge warp if possible, but don't part it, for if you do you will have to let go the anchor again.

With the main and cross-jack yards braced up for the port tack, and the fore yards braced up for the starboard tack, the vessel's head will fall off to starboard, assisted by the action of the kedge. Hoist the jibs as soon as the wind is on the port bow, and haul the sheets to windward.

When the wind is about 4 points on the port bow haul round the fore yards for port tack and sheet home the lower topsails.

Slack away the weather jib sheets and haul well aft on the lee ones.

If you cannot heave home the kedge anchor cut or part the warp.

Get the bower anchor on board as soon as possible, then set sails as necessary.

## COMING TO AN ANCHOR.

In these directions it is assumed that the vessel is about to enter a bay or roadstead, where many vessels are riding, with an off-shore wind.

Before you draw in amongst the vessels riding, take in all the light sails, outer jib, mainsail, and crossjack, and if there is time, stow them, if not, let them be snugly hauled up, and hang in the gear.

Being now close to the position in which you wish to anchor your vessel, clew up the lower topsails, and haul the foresail snugly up.

The vessel will now be under her three upper topsails, inner jib, and spanker.

Now cockbill the anchor, see the chain is clear of the anchor stock, and all ready for running, having previously overhauled a good range of chain, if you have not a patent windlass.

In some cases, when the wind is rather shy, it would suit best to come to an anchor under the staysails, jib, and spanker; but whichever plan you adopt, the directions are the same for anchoring.

Now all being ready, down helm, which will shoot the vessel up head to wind, and as soon as she loses her headway, let go the anchor and veer away the cable as required, lowering away the topsails and hauling down the jib at the same time. But if you think the vessel is going to shoot too far ahead of where you wish to place the anchor, let the yards run square, when she will lose her headway very quickly; then drop her down to the spot you select for anchoring.*

If the roadstead is crowded, mind have the second anchor all ready for letting go in case she fouls the first, as slips often occur in the best of regulated families, and the tide, or other local causes unknown to the master, might be the means of the ship fouling her anchor.

Supposing many vessels are lying about, look out and pick out a good, clear swinging berth. Do not try to go in *to windward* of everything, as some of the vessels close in shore may be drawing less water than your own, and lying in perfect safety, where your ship, brought up close to these vessels, might be too near the ground to be pleasant.

Also when going in to windward of everything, the probability is you would have to keep your vessel away before the wind, in order to bring her up. This would give the ship a good deal of headway when you least required it, and would necessitate you having plenty of room under such circumstances to round her to.

Therefore it is more prudent to round the leewardmost vessel's stern and shoot your ship up to windward, as far as she will go, and down anchor.

There are of course, times when this evolution would not be advisable, thus:—If some of the vessels were lying very far to leeward, close

* If the wind is at all light it will be well to leave the upper mizzen topsail and mizzen set till the ship has got her chain, as otherwise she would not take it readily. *(See Plate.)*

over to a shoal, &c., like they frequently do when anchored in the Downs, close over to the Goodwin Sands.

Under such circumstances, with an off-shore wind, it would be advisable to steer a middle course, and pass to windward of the leewardmost vessel, and pick out as clear a berth as possible.

If it was blowing hard, and you were beating in to an anchorage under double-reefed sails, both anchors must be ready to drop at a moment's notice, as the sails must be carried up to the last moment before letting go the anchor.

Your crew's activity and smartness must now show themselves to the best advantage.

When close up to the anchorage, up mainsail, and let it hang in the gear, then the foresail, and down jib, hard down with the helm, let go the topsail halyards, and as she rounds to clew up the lower topsails; and when she is head to wind, and loses headway, let go the anchor. If you are in seven or eight fathoms of water, give her 30 fathoms of chain; of course more if the water is deeper. Now sheer the ship well broad of her anchor by filling or backing the yards as required. If the port anchor is let go, port the helm, and sheer her to starboard. If the starboard anchor is let go, hard-a-starboard, and sheer her to port, assisting her to do so with the foretopmast staysail.

When you see the vessel is well broad of her anchor, and taut sheered over, let go the other anchor, and pay away chain on both cables till she has 75 fathoms on the first anchor let go, and 45 fathoms on the second; she will then be fairly moored, if, as I said before, she is in seven or eight fathoms of water.

If the gale was exceptionally heavy, of course she would require more chain than mentioned above; for you must always bear in mind she had better have fifteen fathoms too much than one fathom too little, as the cable is easily shortened in when the weather moderates.

In Algoa Bay, and other exposed roadsteads where cargo is loaded, vessels ride by 12-inch coir hawsers, called springs.

These springs are made securely fast to riding bits or bollards in the after part of the vessel, then led along the deck forward, passed underneath the windlass, and nippered securely on to the cable chains.

The vessel then rides by the spring, and they, being coir, give and take with the sea. Care must be taken that the deck, in the wake of where the spring is bent on the chain, is protected from chafe by mats or planks. The turns of the chain round the windlass are slacked up and overhauled sufficiently for the give and take of the coir spring.

Vessels that are so fit, ride out gales of wind that it would be

impossible for ships to ride out with their cables alone; and this spring greatly facilitates loading cargo in such dangerous roadsteads.

These coir springs are generally 30 fathoms in length each, twelve inches in circumference, and have a long eye-plice in one end.

When bringing a vessel up, do not let her drop over the top of her anchor, and see that she brings no weight on the cable till a considerable quantity of chain has run out or she will probably start the anchor out of the ground; and once she starts the anchor it will not bite again, if the bottom is foul with seaweed or kelp, or if the ground is rather hard, until the second anchor is let go.

If you let too much chain run out when letting go the anchor, it falls down over the stock and fouls the anchor; consequently it will not hold at all.

Great vigilance should be exercised by the officer who lets go the anchor in this respect, as more foul anchors occur through paying out too much slack chain than from any other cause. This officer should always keep informing the master how the cable grows when bringing up, and point with his arm the trend of the chain; as the master being aft he cannot see the chain himself, and without knowing the trend of the cable he cannot manœuvre the ship to ease her up to her anchor unless the officer on the forecastle keeps him well informed; and I would fain impress this matter strongly on the minds of young officers.

A smart officer on the forecastle, who keeps his eyes about him, and does not forget he has a *tongue* in his head, on a dark night, when coming to an anchor, is worth a great deal to a master of a heavy ship.

Many seamen prefer to lie to a single anchor, with a great scope of chain out, in preference to riding with two anchors. A vessel moored with two anchors will put more weight on her cables than a vessel riding to a single anchor, and the more spread two anchors have the greater the weight she will heave upon the cables.*

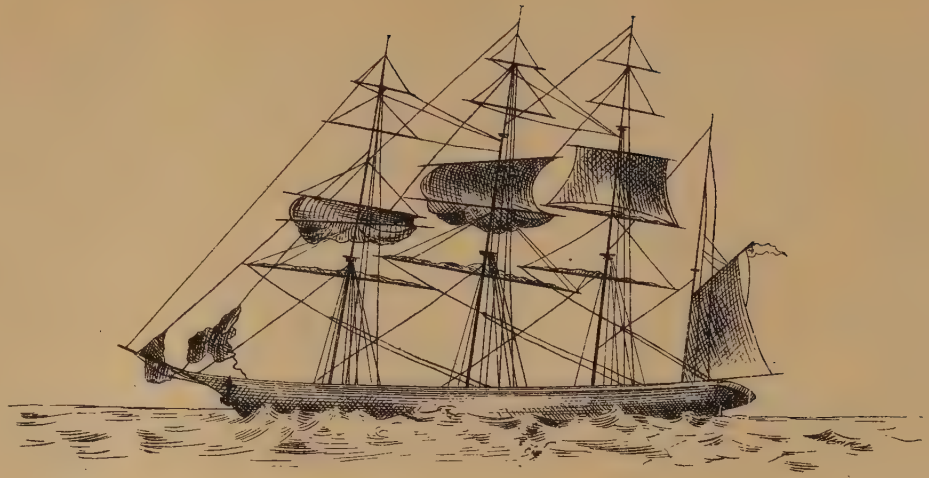
Then again, one cable is easily slipped, and you have a cable and anchor all ready for shifting your berth to a safer anchorage.

Yet at times two anchors are absolutely necessary, in such places as narrow rivers, where you have just room to swing.

Say you want to moor ship in a narrow river, with one anchor for the flood tide and the other for the ebb, in 7 or 8 fathoms of water.

When you let go the first anchor give her 60 fathoms of chain, with

* A shipmaster tells me that on one occasion, when riding out a gale in a dangerous position (pilot in charge), the pilot said that if he dared he would ride on one anchor, but that if anything happened the Board of Trade would be "down on him" for not using the other. A smart seaman doing his best in a position of danger need fear no reprimand from the Board of Trade.



COMING TO AN ANCHOR—ROUNDING TO.

Fore and main topsails in, jibs down.
Mizzen topsail and mizzen left set, to help the ship into the wind, helm a-starboard.
When she is to the wind and gathers sternway, let go anchor.

*Plate No. 64.*

the yards flat aback, if the wind is ahead, to tighten the chain. When the 60 fathoms is taut out, let go the second anchor and heave in on the first anchor, slacking away upon the second till you get the 30 fathom shackles inside the hawse-pipes on both chains. She is then moored for flood and ebb tide, and both shackles being inboard, the hawse is easily cleared if she takes turns in the chains.

It is not unnatural perhaps that the seaman reading this may ask himself the question: how a sailing vessel came up a narrow river with the wind ahead?

Well in the majority of cases she would be towed up, for there are few navigable rivers in the world now that tug-boats are not available, and it would be more advisable to secure their services at the cost of a few pounds than run the risk of grounding, more especially as the crews of vessels are now so limited in their effective numbers.

Disregarding the effect of tides for the moment and taking the wind only into consideration.

Assuming the wind to be on the beam, it naturally follows that after the first anchor has been let go the vessel will blow across the trend of the river and the placing of the second anchor would entail some difficulty.

In this case we should have recourse to what is known as a running moor, viz., letting go one anchor and running on until the required position of the second anchor is reached.

The amount of way neccessary must be in accordance with the size of the vessel, for the heavier the vessel the longer will progress through the water be maintained; also that which is of great consideration; the greater the power required to bring her up, if the cable is used to do so in any measure.

Having the wind on the beam then and the way reduced to a reasonable working limit.

Let go the weather anchor and pay out the cable cheerily, but not so quickly as to override itself, taking into consideration too, that with a taut cable you will be knocking the paint off the bottom of an iron or steel ship and damaging the copper in a wooden one so sheathed.

When the 60 fathom shackle appears on the fore side of the windlass, back the main and cross-jack yards and lower away the fore topsail, assuming that the topgallant, lower topsails and courses have already been taken in.

With good management the way will now be entirely off the vessel, so let go the second anchor and lower away the remaining top-sails as soon as sternway has set in.

Slack away 30 fathoms of cable on the second anchor as you heave in to 30 fathoms on the first anchor.

The vessel will now lay between the two anchors and her swinging area be limited in such a manner as to prevent her stern approaching too close to either bank, or encroaching too liberally upon the limits of the fairway, so becoming a danger to yourself and to others having the right of way.

Bringing the question of tide into the subject, due consideration must be given to the relative strength of the wind and tide.

A running moor could be easily made with the wind right after and the tide ahead, and it would have the advantage of being able to drop down with the tide towards the first anchor, after having let go the second anchor, all canvas having been taken in.

To attempt a running moor with both wind and tide astern would be unseamanlike, except under exceptional circumstances.

We will put "under exceptional circumstances" because—outside of the Houses of Parliament—there is no calling or profession, or trade, whose members are so prone to argument as those of seamen.

With the wind and tide right aft, turn the vessel round head to both, or as nearly as it is possible to do so. If it is not possible to get right round, then snub her round by lowering away the first anchor and letting it grip and drag sufficiently to effect the purpose without parting the cable.

Sometimes two anchors are compulsory when riding in bays where there is no sensible tide, and heavy winds prevail, which cause the vessel to sheer madly about when blowing hard, if riding to a single anchor. Here a second anchor is necessary to steady the ship, and it prevents her starting her anchors.

In open roadsteads of bad repute have everything ready to slip at a moment's notice, so as not to have to look up the necessary gear after the order is given to slip cables. Have a good buoy and buoy-rope fit for each cable, with the ship's name painted on the buoy. See the shackle pins are in good order abaft the windlass, and have a hawser ready to pass out of either quarter you may require it, to bend on the cable, to cast the ship, if a sudden gale sprung up, and it is found necessary to slip.

How often gales spring up on a dark, dirty night. Then how inconvenient, not to say dangerous is it to be hunting about for shackle punches, buoys, buoy-ropes, &c., and getting a hawser up from below, to bend on the cable for a spring.

Yet such, alas, is often the case; and it is mentioned here just to warn young officers not to be caught napping, for they will find themselves, if they neglect these precautions, far astern of other vessels who have kept in mind the old sea order, "See all clear *before dark.*"

Many seamen when riding in exposed bays keep a good spring from the quarter made fast to the cable on the side dangerous winds are expected, for, besides being useful in slipping the cables, it is found very serviceable in steadying the vessel when a swell sets in the bay during fine weather; for at such times, if a spring is kept well taut, it will head the ship up to the swell, and facilitate taking in cargo immensely.

And there can be no doubt that a spring made properly fast, and the cable parcelled in the wake of where the hawser is made fast to it during fine weather, is to be preferred to one made fast in a hurry, on a dirty night; for I can assure my readers it is anything but an easy job, on a dirty night, to get a hawser bent on to a cable chain, below the hawse pipe, when perchance the ship is beginning to dive her bow into the sea.

Yet for all this many shipmasters will not keep the spring bent on the cable, but keep the hawser in readiness passed along from aft, on to the forecastle, alleging as their reason for doing so that the hawser may get chafed in fine weather near the cable, and when actually wanted to cast the vessel, it often breaks, causing the ship to be placed in great jeopardy. But I think, all things considered on both sides of the question, keeping it always bent is far the best mode of procedure.

When bringing up in such exposed places as mentioned above, put a good reef in each of the courses, and upper topsails; you are then prepared for action, if bad weather sets in, when the signal is made to slip cables.*

* If riding heavy, good tackles should be placed on the cable before and abaft the windlass, and hove well taut. This eases the strain on the windlass.

When bringing up at night-time, see the anchor riding light is well trimmed, and the glasses properly cleaned; also have a couple of good deck lamps ready lit, in case the anchor light blows out—you then have a lamp to replace it for the time being. Also see the anchor light is hung on the side of the ship you may expect the most traffic, and shifted over when the ship swings. And see the relieving tackles are placed on the tiller-head, and hove taut.

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SECTION XVIII.

## TACKING AND WEARING.

Keep the ship a good clean full for stays, haul the cross jack up, and let the lee-tacks and weather-sheets of the courses be cast clear of their beckets. Lay all the braces down clear for running.

The order is now given, "Ready about!" (stations). When all ready, ease down the helm till it is hard a-lee. When it is hard over the order is, "Hard a-lee!" Let go the fore-sheet, haul in the spanker-boom amidships, ease a bit of the lee fore-brace, and ease off the head-sheets and overhaul them.

The ship is now flying up into the wind. The moment you see all the square sails shivering the order is, "Tacks and sheets!" The tack and sheet of the mainsail are now let go (keeping the bowline fast), and the clews, and also the lee-clew of the foresail raised a bit, that the clews may fly clear of the rails when the yards are swung. Sometimes the fore-tack is also hauled up (keeping, of course, the bowline fast); but this makes a bag of the sail, and makes a backsail of it.

When the ship comes within about a point and a half of being head to wind, the order is, "Mainsail haul!" The after braces and main bowline are now let run, and the after-yards swung sharp up on the other tack. Then board the main tack and aft-sheet whilst the wind is out of the sail.*

*If this order is given at the right moment the yards will swing of themselves, and if a good run is made with the braces they should be run nearly sharp up on the other tack in one run. If left till head to wind the sail will be becalmed, and before it can be got sharp up the wind on the other bow will cause a "dead haul."

The crew now jump forward and stand by the fore-braces, the forecastle hands being engaged hauling over the head-sheets and trimming the jibs.

As soon as she pays off enough for the main topsail to fill the order is given, "Fore bowline—let go and haul!" The fore-tack and bowline are then let go, and the fore-yard hauled round and braced up; but if you see she is about to pay broad off, 'vast bracing the fore-yard sharp up, and if she gets sternway upon her change the helm.* Flatten in the spanker-sheet, and ease off the head-sheets. When she begins to come up towards the wind, ease off the spanker-sheet, haul aft the head-sheets, brace the fore-yard sharp up, down fore-tack, aft fore-sheet, and meet her with the helm.

When the ship comes close to the wind give the square sails a shiver, and bouse well taut the weather fore, main, and crossjack braces.

It is customary to have a mark on the topsail braces, so that when the yards are far enough forward a turn may be taken at these marks; for you must always be careful that the weather topsail braces are not left slack when the yards are braced sharp up, or probably a sprung yard would be the result.

Place now the lee-tacks and weather-sheets in their respective beckets, and set taut the bowlines fore and aft; then coil all braces down clear for running, and see that all slack ropes are hauled taut fore and aft, for nothing looks so slovenly to a good seaman's eye as to see a lot of running gear flying away to leeward in bights, as if they did not belong to the ship.

It may happen sometimes that after the mainyard is swung the vessel begins to get sternway upon her. If such is the case, and she commences to pay off again on the old tack, shift the helm a-lee again, square the after-yards, haul aft the head-sheets, and in with the spanker. When she has gathered good sternway, shift the helm and shiver the after-yards. When the wind comes aft, square the head-yards, shift over the head sheets, and brace up as she comes to on the other tack.

In olden times, when vessels were built much shorter than they are at the present day, they stayed much quicker than the long vessels of this era; and often, when it was blowing hard, and they were under double-reefed topsails and courses, if the water was smooth, stayed with the greatest of ease. Under such circumstances our long vessels of to-day would have to be wore round, for to try and stay them under canvas, as mentioned above, would I think be next to impossible.

As the mainsail in large ships often greatly interferes with the

* On a dark night the extra strain on the wheel will tell you if she has sternway.

working of the fore-braces, it is often customary while in stays to raise the clews of the mainsail, and board the tack after the vessel is round.

If the vessel carries a crossjack, it is usual to haul the clew garnets nearly right up before commencing to stay the vessel; and if you are about tacking up a narrow channel, by all means furl it out of the way.

When working a vessel in narrow waters, if at all shorthanded, keep both mainsail and crossjack stowed, as the ship will work considerably easier. The order when the main yard is turned round is then, *Main topsail haul,* instead of *Mainsail haul.*

In tacking a four-masted ship it is the general custom to throw the jigger yards aback before putting the helm down, and bracing them sharp up on the other tack; she is then handled as a three-masted vessel. If the jigger mast is barque-rigged, of course the yards will be swung in the usual way.

It is customary in large vessels, when tacking ship, if a strong breeze prevails, to let the light staysails run down, and dip the sheet over the fore-and-aft stays before re-setting them. This is done for two reasons, viz.:—Firstly, it saves the sails getting a severe shaking whilst the ship is head to wind; and secondly, these staysails are generally fitted with single sheets, and if so, hauling them down becomes a necessity. But staysails should by rights be fitted with a tripping line on the clew, then in the event of a sheet parting, or getting loose, the sail can be tripped up and steadied. The same can be done when going about, unless there is too much wind. This line also greatly assists in dipping over the sheets, and does away with the necessity of starting the halyards; it also hauls the clew up when the sail comes in, and snugs it for furling.

The main topmast staysail should also be either hauled down or tripped up before going round, as the sheet interferes with working the fore-braces, and as it is a large sail, with a heavy sheet, it would be very unhandy to dip it over the mainstays.

In tacking, ships are often baulked by mismanagement in hauling aft the head-sheets too soon. See the head-sheets are never hauled aft till the wind will fill the sails on the right tack.

## A TABULATED FORM OF TACKING SHIP.

READY ABOUT.—See that all your crew are at their respective stations.

HELM'S-A-LEE, LEE OH! OR EASE OFF! } (All three terms are used).—Ease off head-sheets, let go fore-sheet, haul spanker-boom amidships, and check lee fore-brace.

TACKS AND SHEETS.—Up clews of mainsail, and lee clew of foresail, sufficient to clear the rails.

MAINSAIL HAUL, OR TOPSAIL HAUL.—When about 1½ points from being head-to-wind, let go the lee braces, and run round the after-yards; board main tack, aft main sheets; haul aft the head-sheets when paid off sufficiently for the head-sails to take on the right tack.

FORE BOWLINE.—Let go fore tack and bowline, and overhaul them.

LET GO AND HAUL.—Turn round head-yards, board fore tack, aft fore-sheet, and out bowlines.

Haul well tight the weather lifts and lower braces, and coil all ropes clear on their pins ready for immediate action. Do not forget, before hardening the yards sharp up, to let go the lee lifts.

## WEARING SHIP.

When under all plain sail, and you wish to wear, haul up the mainsail and crossjack, down main topmast staysail, and in spanker. Ease away the lee main and crossjack braces, to keep the sails lifting, and hard a-weather with the helm. When she begins to pay off, haul away upon the after-braces, and keep the after-yards lifting until you have them with a cant on the other tack.

When the wind comes aft, let the fore-yard run square, and haul the head-sheets over; then, as she comes to the wind, brace up the after-yards, out spanker, up main topmast staysail, down main tack, and brace the head-yards up. Mind she does not take charge and come to too quickly, as remember the fore-yard has to be braced up last of all.

Many seamen when squaring the head-yards brace them sharp up on the tack they are going to put the vessel on; but this evolution is not advisable with a long vessel, as it retards her coming to quickly, but it is commonly done on account of having plenty of men on the after-braces, especially so if you are wearing ship with only the watch on deck.

This evolution of wearing is seldom put in practice, except when the weather is too heavy to tack, or if in consequence of a heavy head sea or swell the ship is not likely to stay.

When wearing ship in a heavy gale, with a high sea running, great precaution is necessary, as she may have too little canvas on her to keep her before the sea, and get her decks swept, especially if deeply laden.

Say you are head reaching under the three lower topsails, and fore topmast staysail, and require the vessel placed on the other tack.

Firstly, secure all the deck openings, such as companions, ventilators, skylights, &c. Loose the foresail, and set the sail. But if the gale is exceptionally heavy, and you consider a whole foresail is too much for her, then keep the weather clew garnet fast, and only haul aft the sheet, as it will be quite sufficient to wear the vessel under these circumstances. Watch a smooth and put the helm up.

As the vessel goes off, square in the after-yards, keeping the topsails lifting* till they have a cant on the other tack; then square the fore-yard and get the staysail sheet over. When the wind is on the other quarter, ease the helm so as not to let the ship fly up in the wind, as she will then be going fast through the water, and might ship a heavy sea; but ease her to the wind gradually, bracing the yards up as she comes to. Then up foresail, and stow it, when the vessel is by the wind.

When wearing in heavy weather, mind and have careful hands at the weather-braces, so that too much is not slacked away when bracing up, thereby leaving the yards without support.

## MISSING STAYS AND TAKEN ABACK.

When a vessel comes head to wind, and pays off again on the tack she was previously on, she has then what seamen term *missed stays.*

Say a vessel is on the starboard tack, and has missed stays. Keep the helm hard a-port, as she will probably have stern-way upon her; flatten in the head-sheets, brail in the spanker, raise the clews of the mainsail, and square the after-yards.

When the fore-yard fills, brace up the after-yards, set the mainsail and spanker, and change the helm. Then keep her a good clean full, so that she will have good headway, before trying to stay her again. But if you conclude to let her come round on her heel, when the fore-yard fills, keep the after-yards shivering till she goes well off, then square the head-yards, put the helm hard a-starboard, and when the wind is on the port quarter, brace the after-yards sharp up; then the head-yards, and bring her to on the port tack.

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* Keep the sails lifting from the first, or else it will be nothing but hard pulling, *with no result*, until the wind is right aft.

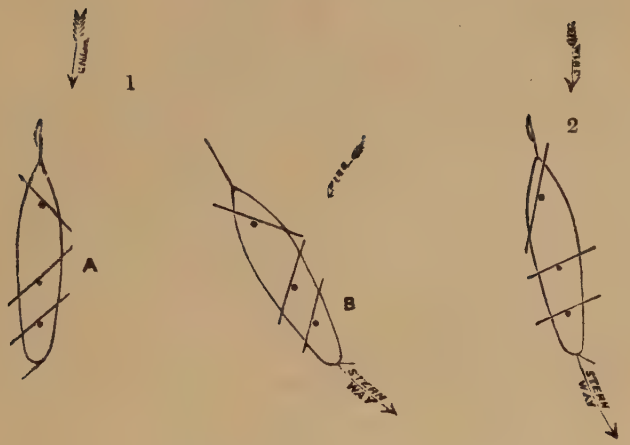



*Plate No. 65.*

## TAKEN ABACK.

Say you are on the starboard tack, and the wind has shifted suddenly, coming right ahead. Flatten in the head-sheets, let go fore-tack, sheet, and bowline, and turn the fore-yard round, changing your helm at the same time. This will what seamen term *box her off*. As soon as she goes far enough off for the after sails to fill, let go the head-sheets, and turn the fore-yard round as it was before you were taken aback, down fore-tack, aft fore-sheet, haul out the bowline, and change the helm. But if she refuses to box off, and keeps coming round on the other tack, turn the after yards round, and act as you would if staying ship. *(See Plates).*

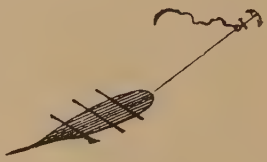
In case you do not want her on that tack, then let the yards run square, and wear her round, bracing the after yards up when she brings the wind on the quarter, and keeping the fore-yard square till she brings the wind abeam. Then brace it sharp up, board tacks, aft sheets, and out bowlines.

In very light weather, and you are doubtful of her staying, when raising the tacks and sheets, down flying and outer jib, resetting them after the ship is round.

No. 1.
Let go the anchor

No. 2.
Slip the cable, holding on to the spring.

No. 3.
Round with the after yards.



No. 4.
Round with the head yards and cut the spring.

*Plate No. 66.*

## To Cast a Ship when on a Lee Shore in the last extremity, sometimes termed "Club-hauling."

*(Plate No. 66.)*

Cock-bill the lee anchor.

Pass a good hawser out of the after warping chocks along the lee side, and bend it to the ring of the anchor.

Range sufficient cable on deck, say 45 fathoms, and knock out the shackle pin at that length.

Down helm, checking the lee braces: as soon as she comes towards the wind, *Let go the anchor.* When head to wind, *Slip the cable,* holding on to the spring.

As soon as a strain begins to come on the spring, and she falls off on the other tack, get the after yards round, then when the after sails fill haul the head yards round.

As soon as all the yards are full, slip or cut the spring. She ought now to reach away on the other tack.

This is an expedient *for the last extremity.* It is doubtful if the weak crews of the present day could get the yards round quick enough, and the spring might carry away before it had done its work. But when there is no other chance this might save the ship, as it has done in bygone days.

## ALTERNATIVE METHODS.

### 1. The Sternboard Method.

Should, however, the water be too deep for anchoring recourse must be had to making a stern board, or of bringing the vessel round on her heel.

In the former case the helm is put hard down, and when well up in the wind or you see that the helm has lost its affect for headway, haul all the yards round, keeping the helm a-lee.

As the vessel comes astern her head will pay off, and here again is a case for watching until you find that the astern action has lost its affect, then square away the fore yards and put the helm over the other w .y for headway.

Haul the after yards gradually round to the square as the vessel's head goes round before the wind, and when the wind is right aft, brace them up for the tack that the vessel is coming round to, and then haul round the fore yards for the same tack.

As regards the fore and aft sails, the main and mizen staysails should be hauled down before commencing the manœuvre.

Directly the helm is put down all head sheets should be let fly, and the spanker boom hauled well amidships, then in spanker and haul aft head sheets when the vessel's head commences to pay off.

Wind aft and coming round to the other quarter, ease off head sheets again and haul out the spanker to increase the pressure aft, so making the turning movement in as small an area as possible.

The foregoing remarks will apply to the vessel being either on port or starboard tack when extreme measures had to be taken, and the same applies to the following, which, however, we will accompany by a diagram of the movements, as it is rather more widely practiced than the stern-board method.

### 2. Box hauling.

Under the same conditions as before, and assuming that it is a full rigged ship on the starboard tack.

If main, and, or, mizen staysails set, haul them down. All ready. Down helm, spanker boom amidships. When the ship has lost headway, or when she fails to come any closer up into the wind, haul round the fore yards.

Square the main and crossjack yards and brail in the spanker.

The ship's head will now fall off away from the wind and sea.

Put the helm up, viz., Hard-a-starboard as soon as headway is obtained. With a heavy sea running it would be as well to put the helm amidships when the main yards are squared.

When before the wind slack away the port fore staysail, sheet and haul aft on the starboard one.

When the wind comes round to the port quarter brace the main and crossjack yards up for the port tack. Watch the helm carefully as the ship comes up to the wind.

These orders are printed in short and terse terms, but there can be no hard and fast sequence of orders in handling a square rigged vessel under troublesome circumstances.

You cannot expect to become a first rate seaman by reading seamanship books only, books give you the idea, keen observation when on board will ripen those ideas, and experiences create the seaman. Make yourself a small flat bottomed model for practice, and an arrow to represent the wind, then reason out the why and wherefore of each action. An experienced examiner can sum up your qualifications in five minutes or less, and know if you are solely book learnt or ship drilled.

### In a Steamer in like Circumstances.

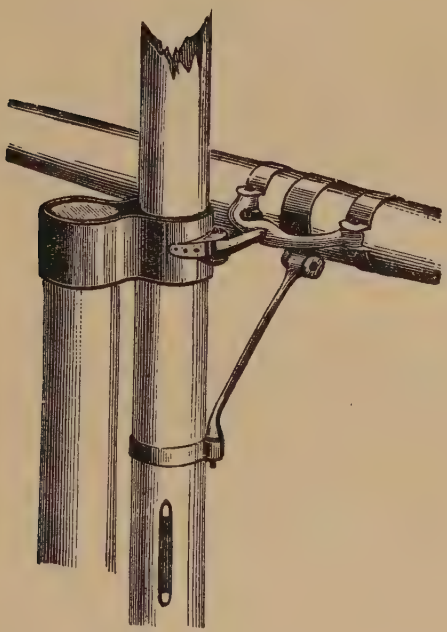
Down helm, and let go anchor.

When head to wind, give her full speed ahead, and when she cants slip the cable.

This evolution has succeeded more than once in late years on the N.E. coasts,

## SECTION XIX.

# TOPSAILS AND REEFING SAILS



Truss and crane of lower topsail yard.

*Plate No. 67.*

The old-fashioned single topsail is now seldom met with, unless as the mizzen topsail of a ship of small tonnage, or in coasting vessels. In these instances it has three reefs in it, and being a small sail, is easily handled. For all sailing vessels the double topsail (formerly termed Howe's rig, from its inventor, an American shipmaster) has long ago proved its infinite superiority over all other kinds of topsails. Short-handed steamers carrying a fore topsail may possibly find advantages in the patent topsails invented by Lieut. Cunningham, R.N., or the other patent rig of Messrs. Colling and Pinkney, of Sunderland, but neither of these are suitable for a sailing vessel of very large size, as. when fitted to large yards, the sails are too cumbersome

to be easily handled, and the result is that, in reefing, the sail is often split, and as they are not so easily shifted as an ordinary sail, much trouble and inconvenience is the result, as well as the attendant expense; but in small vessels they answer very well. The double topsail, as its name implies, is a topsail in two halves, an upper and lower; the topsail-yards, also, are two instead of one.

The upper topsail-yard is parralled to the topmast, and hoists and lowers by halyards in the same manner as the old-fashioned single topsail-yard.

The lower topsail-yard is trussed to the lower cap, in the same manner that a lower yard is trussed to the lower mast, but instead of being suspended by slings, is supported from below by a crane or iron stay, which works in a socket, either upon the forward rim of the top or else on the heel of the topmast, some feet below the lower cap.

The rigging of the yards and sails has already been sufficiently explained.

The advantages of the rig are obvious. An upper topsail can be carried as long as a double-reefed topsail, and, with the single reef in, can be hung on to if necessary in very heavy weather. This is particularly valuable when running in a heavy gale, with hard squalls and lulls, where it is necessary to carry on to keep the ship ahead of the sea; when, if a squall is too heavy, the yard can be run down, and when the squall is over, can be easily hoisted again; whereas to reef down a ship with old-fashioned topsails in such weather was often a four hour's job for all hands. When necessary to stow the upper topsail you have left a close reefed sail (in the lower topsail) with a yard of its own, well bent, with no badly tied reef-points, and a sail that, if necessary, can be clewed up and furled, in anything short of a hurricane, easily, and without losing the sail.

The two afore-mentioned patents are both topsails which roll up (by hauling on halyards *on deck*) like a window blind, the principal difference being that in Cunningham's patent the topsail-yard *itself* rolls, and winds the sail round itself, whilst in Colling and Pinkney's rig the sail rolls round a rolling spar, which is fitted on the fore-side of the yard. Cunningham's yard has a light spar on the after-side, termed a chafing spar, which carries the footropes and studding-sail booms. As there is nothing very intricate in either system it will not be necessary to go into further detail; should the young seaman be shipmates with either rig he will learn how to work them without much trouble. But, as a word of caution, it may be well to add that if it is attempted to roll up a heavy sail with either of these rigs,

unless the vessel is kept right off before the wind, and the yard squared a little, the chances are that it will not roll up evenly, and a split sail will be the result. Cunningham's yard will also be found a very heavy one to hoist. It may also be noted that the Cunningham sail only rolls up to a close-reef; by Colling and Pinkney's method the sail can be close-reefed, and then by slacking away the sheets the whole sail can be rolled up, thus doing away altogether with the necessity of clewing up and furling by hand. This rig is well adapted for steamer's topsails.

Double topgallant yards on a similar principle to the double topsail are now fitted to many ships of heavy tonnage, and are an undoubted advantage when running with a strong gale, as they can be carried on to much longer than a whole topgallant sail; and when it is necessary to take them in, can be handled twice as easily. In the case of double topsails the lower cap is supported on the after side by cap-shrouds. In the case of double topgallant sails the topmast-cap is similarly supported by topmast-cap backstays.

Upper topsails and topgallant sails are much handier if fitted with sheets and clewlines, the sheets in these cases being usually short, and not long enough to allow the clews of the sail to be fully clewed up, their use being to slacken the foot and leaches sufficiently to make the sail easy to furl.

It is more usual, however, to have the clews of the upper topsails lashed or shackled to the lower topsail yard-arms, as in *Plate No. 68.*

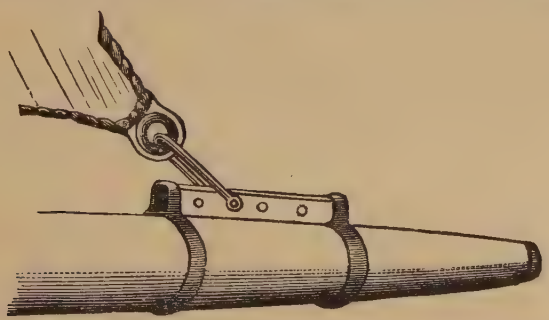


*Plate No. 68.*—Ordinary method of securing upper topsail clews.

## TO REEF THE FORE COURSE.

Call all hands. Clap on the fore lifts, and rouse them well taut, at the same time easing a little of the lee fore and topsail braces, if by the wind.

If she is head-reaching, or close to the wind, the head-yards may be

shivered a bit, great care being taken that she does not lose her way and come to. Now haul the foresail up, leaving both clew garnets about two-thirds up, the other gear close up. Get plenty of force on the weather-reef tackle, and rouse it out two blocks, slacking the leach-line if necessary. Then the lee-reef tackle the same way.

All hands aloft. Reef the sail, with an officer to superintend in the slings of the yard, whose duty it is to see the reef-band is taut along the yard before making the reef points fast.

If there are studdingsail booms, these must be triced up to the rim of the top, out of the way, before the men go out on the yard.

After the two men at the weather-earing have rove it through the reef cringle, and are all ready for hauling out, they call out, "Light out to windward." Each man then seizes hold of a reef point, and pulls the sail to windward until the weather-earing is far enough out, when it is made fast. The order is then given, "Haul out to leeward!" The men then light the sail over to leeward, to assist the men at the lee-earing; and when the reef band of the sail is taut along the yard the officer gives the order to make fast the lee-earing and tie the reef points.

When tying the reef points, if fitted with points on both sides of the sail, pull the after leg of the point the tightest, and haul the reef knots well taut, or they may shake adrift. If the sail is fitted with single points on the fore side of the sail only, two are taken together, half-hitched round the jack-stay, and then knotted to each other.

Let the men at the earings look well to the dog's lug, and keep it well on top of the yard when making the earings fast. (The dog's lug is the roping of the sail between the head cringle and the reef cringle.)

When all is made well fast, let the booms down upon the yard, secure them, and overhaul the reef tackles well before the men go on deck.

Mind leave two men aloft to overhaul the buntlines and leachlines whilst the men on deck are setting the sail.

The officer who is on the yard must now go and overhaul both earings, and see the reef points are properly made fast, all of them having an equal tension, except the dog's lug points, which must be a little slacker than the rest. When this is done then set the sail.

## REEFING TOPSAILS.

The upper topsails are much easier to reef than the courses, for when upper topsails are lowered down they fall before the lower topsail, and to a certain extent lie becalmed.

Lower the yard down, keeping the downhauls square; if fitted with upper topsail sheets, they must be started, and the sail clewed up if necessary. When the yard is on the lifts, lay the two yards parallel with each other, and reef the sail.

If the course is in, or the vessel by the wind, shiver the sail whilst reefing; but remember, if you touch the braces, that there are men on the yard, and that the lower topsail if it begins to shake heavily may jerk someone off.

## REEFING FORE-AND-AFT SAILS

Great care must always be exercised in reefing fore-and-aft sails, as they more frequently get split than square sails, and it invariably happens through the earings and points not being properly tied. In reefing a fore or main trysail, if the gaff is a standing one, that is, one that does not lower down (and these kind of gaffs so fitted are common in most of southern going vessels), firstly, clap on the head downhaul, and haul the head of the sail snugly down, at the same time taking in all you can get of the lee brails; then ease the sheet off as much as possible, till the upper brails are close up. The lower brails of course will not be close up, but get all you can of them, taking in the slack of the weather ones.

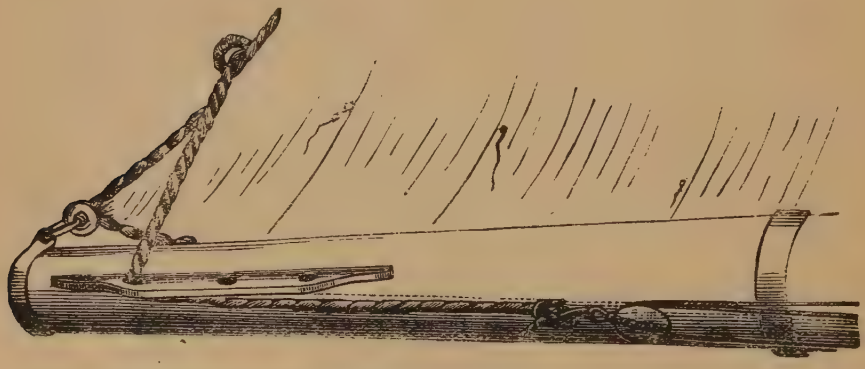
Now take a good reef-earing, about three-and-a-half fathoms in length, and reeve it in the clew cringle, pass it through the reef cringle, and lash the two cringles close together; then place some parcelling round the sail in the wake of the earing, and take several turns of the earing right round the sail, over the parcelling; an old gunny bag is mostly taken for this job. Be careful in gathering up the foot of the sail taut along from the reef cringle to the foot of the luff cringle, for if the foot gets puckered between the points when rousing the sheet aft it will have a great tendency to split the sail. But fore and main trysails with standing gaffs are clumsy sails to reef, and if it is blowing that hard that the sails must be brailed in altogether, and the sheet let go, this complicates matters, and it is next to impossible under such circumstances to whip in a good reef. The sail should not be *rolled*, but gathered up, and the footrope left taut along underneath to take the chafe off the points, which must not be tied *too* taut.

But on the other hand, if it is a spanker with a running gaff, which lowers down on deck like a schooner's mainsail, reefing it becomes an easy matter, and a first-class reef may be put in.

Act thus:—Reeve a reef pennant through the boom end in the cleats fitted for that purpose, have a tackle handy before lowering away

the gaff; lower away the jaws of the gaff till it is as far down as necessary—nearly right down if you are going to close reef it—then ease away the peak halyards a couple of fathom. Let a couple of hands get on the boom, which beforehand must be well steadied by the guys and sheet, let them reeve the reef pennant through the reef cringle, and then through the hole in the reef cleat at the end of the boom, and hook on the tackle to the end of the pennant, the other block of the tackle hook on about the gooseneck, at the inner end of the boom. Get plenty of men on this tackle, and rouse the reef cringle well out to the end of the boom, at the same time putting a small tackle—the handy billy will do—upon the reef cringle belonging to the same reef on the luff of the sail.

When the reef cringle is as far out as you require it, and the reef band tight from the mast, put some parcelling on the sail in the wake of the reef cringle, and pass an earing with seven or eight turns through it and round the boom end, binding the cringle taut down on top of the boom. Then let the hands distribute themselves along the sail, gather up the foot evenly, and tie all the points. The sail is then reefed, and if care has been exercised in gathering it up, it should stand quite as well as a whole sail.



Reef pennant of spanker.

*Plate No. 69.*

But if the sail has no boom, and it is a running gaff, keep the sheet fast, lower away the throat and peak halyards as much as you require, then take a good reef earing and reeve it through its own part in the clew cringle of the sail, and lash the clew cringle to the reef cringle; then finish off the end of the earing by taking several turns right round

that part of the sail contained between the clew and the reef cringles. Do it as snugly as possible; but you cannot help a very ugly bunch of canvas and rope combined hanging and dangling about the clew of the sail in trysails which have a standing gaff and no boom.

In finishing off the end of the earing, mind and take a round turn round the cringle before hitching the end. This will prevent the hitches jamming when rousing aft the sheet.

In conclusion we may add, too much care and caution cannot be used in reefing any sail. If you trust all to the crew (mind, some of them may be very young at the profession), and not set an officer to overhaul the reef before setting the sail, you may go scot-free many times, but there *will come a day* when you will lose a sail. And mind this might occur at a very inopportune moment—perchance when beating off a lee shore—when the safety of the ship and all hands' lives are concerned; for you must ever remember that amongst a large vessel's crew there is generally some luckless wight who is neither soldier nor sailor, who knows nothing about reefing a sail, and cares less. Yet he counts one on the yard, and ties his points accordingly, *as he thinks fit;* and it may, or it may not be, a granny's knot, too tight or too slack, &c.

But if a careful officer is aloft, who has some *nous* about him, he will detect this man's shortcomings, and rectify the error before setting the sail.

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## SECTION XX.

## SCUDDING, ROUNDING TO, AND WEARING IN SEVERE WEATHER.

In these days of double topsail and topgallant sails, scudding is an easier business to manage than it was when the topsails were whole sails.

Short bluff ships will run safely much longer than clippers of low freeboard and great length, and these latter ships should be hove-to in time. But it sometimes happens that the vessel has been run too long, and the time for heaving-to is past.

(The writer has a vivid recollection of a case of this kind, where, with double-reefed topsails on the cap, an old-fashioned East India-man was steered for some six or seven hours by the captain himself, the chief officer at the lee wheel, and two quartermasters assisting, until the heaviest of the gale was over, the sea less dangerous, and

daylight had appeared. In this case it was too late to heave-to, and if a sheet had been started, the sail would undoubtedly have been blown to ribbons. One dangerous sea was shipped, which filled level the main deck to the top of the high old-fashioned bulwarks, some seven or eight feet, and washed away the hammock-netting. With this exception she ran it out without accident.)

The best canvas to carry at a time like this is (for most vessels) the lower fore or main topsail, and perhaps reefed upper main topsail, and reefed foresail, *and the fore topmast staysail.* This latter sail should always be carried, when scudding, with the sheets well flat, the weather-sheet being dipped over the stay, and also hauled aft, so that both sheets divide the strain.

Perhaps in the case of running out of a hurricane, when it is necessary to keep the wind and sea quarterly, it might be found that the lower fore topsail would be a better sail than the main. In this case, if the main topmast staysail be a good sail, and not too large, it might be carried with advantage as well as the fore topmast staysail; but it unfortunately often happens that cyclones are encountered when the previous weather has been fine, and the wind perhaps light, so that possibly the best suit of sails is down in the locker. This is a matter worth consideration when crossing a hurricane district during the season.

The chief dangers to guard against in scudding are getting by the lee, or broaching-to.

The first of these is when the wind has been quartering, and the vessel flies off, bringing the wind on the other side, shivering and possibly laying the sails aback. With a heavy, irregular sea running, this is an accident not unlikely to occur, unless the steerage is most carefully attended to. Should this happen, hard up the helm (unless already so), ease away the fore tack and sheet, being careful not to let them run; fill the foresail by squaring in the yard or bracing it round if necessary (the weather-brace being carefully tended), and shiver the lower main topsail. When she brings the wind aft again, meet her with the helm, and again trim the yards as they were before.

"Broaching-to" is, when running, the ship flies up into the wind, and comes a-back. If it is found that she inclines to do this, it is best to set the lower fore topsail (before it happens), as well as, or in lieu of, the main, and perhaps take the foresail in. Should this accident occur, the helm will be already hard up; keep it so; brace the main-yard into the wind, and fill the fore yard, only easing off the weather fore sheet as far as necessary. Should she be under lower fore topsail

and topmast staysail, the fore yard will be easily filled. But whatever means are necessary must be used as quickly as possible to prevent her getting stern-way, as it is almost certain that, if this accident does happen, at least one sea will be shipped before she is again got before the wind; and should she gather stern-way it is a serious matter—it is a position of great danger to be placed in.*

At one time there was a very prevalent idea amongst seamen that in scudding before a storm the main topsail was *a necessity*, as they considered it helped to keep the ship's stern out of the sea. But we believe that idea is now, generally speaking, exploded, and the great bulk of modern seamen have discarded the use of this sail when scudding, for the following reasons:—

It becalms the fore topsail, and takes away its power of directing the ship's head.

If the vessel yaws about much on a high sea, it helps to broach her to.

And the ship's momentum through the water, being derived from a force acting on the centre of the structure, helps to retard the good steering qualifications of the vessel; therefore many modern seamen scud their vessels under reefed foresail, and lower fore topsail.

In scudding, when judgment says it is best to round-to, make all preparations before attempting to do so. In a vessel which is not too heavy aloft, the royal yards can often be sent on deck whilst running, and this will ease considerably the strain aloft; it is seldom possible to get the topgallant yards down in a vessel of any size. Let the carpenter look well to his hatches, see that the wedges are all secure, and that there are no lugs of tarpaulin sticking out for the sea to get hold of. Let the sails all be looked to, and, when necessary, preventer gaskets passed; see that there is nothing that can get adrift, and that the skylights, booby-hatches, and deck-house doors are secured, and heave-to by *daylight* whenever possible.

Haul down the fore topmast staysail and stow it. If the foresail be set, get it in, and as well stowed as possible under the circumstances; and if both fore and main lower topsails are set, take in one of them, leaving set whichever the vessel lies-to best with—if you have not had experience of her, leave the main one set. Now watch the sea. It is a matter of common observation that two or three heavy seas often come together; try and watch for such a slant as this, and as

* If she has come-to, and lies so, probably it would in most cases be best to keep her there and heave her to.

soon as ever the second sea (unless a third one is coming) breaks on the counter, ease the helm down, and run the main yard forward and get the men off deck, seeing also that those at the wheel have got a turn of a line round them. It may be that she will come-to without shipping a heavy sea, but the chances are against it if she is at all deeply laden. As you put the helm down pour a good quantity of oil overboard, and continue to do so as she is rounding-to.

In laying-to under a lower main topsail, the ship will often behave better if the head-yards are checked in a couple of points. The helm must not be lashed hard a-lee, but should be carried about three points down, and in some cases, by tending the ship with the helm, she will lay-to easier.

She will now come-to and fall off, the wake probably trending away abeam, or a little before or abaft it; this will smooth the sea, and to a great extent prevent it breaking aboard. If it is running very heavy, a stout clothes bag, with a few holes punched in it with a roping needle, filled with oil, and payed out by a line to windward, will help very much to smooth the sea, and give a deep laden vessel a better chance of riding the gale out in safety.

Should the topsail be blown out of the bolt-ropes, a tarpaulin must, if required—which is not always the case—be put in the rigging. To do this it must be rolled up neatly, and a few stops must be put round it. It can then be carried into the rigging and placed athwart the shrouds, so that when cast adrift it will unroll upwards. Cast the stops off, let the wind unroll it, and stop it securely in position.

Keep the crew as little exposed about the decks as possible, in case a heavy sea drops over the weather bulwarks.

If you find she falls off very much, and lays herself in the trough of the sea, she then becomes dangerous, and other measures will have to be adopted. If it blows very fierce, reef the mizzen staysail, if you have one, and set it; or if you have a main trysail, haul the foot out, keeping the head in, and put a strong lashing round the head, for fear the down-haul should part.

It may be that, being hove-to, it is necessary to get her round on the other tack. If the gale and sea are very heavy, this will be a matter of difficulty. It has been recommended to use a drag from the lee quarter to help the ship, and perhaps in an emergency this might be resorted to; but under ordinary circumstances it will usually be sufficient to set the fore topmast staysail and fore lower topsail, or perhaps a goose-wing of it. Fill the fore-yard and brace the after-yards to the wind, clewing up the main lower topsail if necessary. Do not jam the

helm hard up. If you watch when she falls off, less helm will do, and so much strain will not be put on the rudder.

But suppose the vessel to have been hove-to in a hurricane on the wrong tack, that the mistake has been discovered, and that it is *necessary for the safety of the ship* that she should be got round.

In the first place, she will be under bare poles, for no canvas can be shown in these storms. A drag must then, if possible, be used; and if this fail it might be necessary to cut away the mizzen topmast, in which case the wreck would probably help her round, if used as a drag, by bending a line to it and holding it on at the stern. This will draw her stern up to windward till she is right off before it. The line may now, if necessary, be passed along forward to bring her to the wind, and if thought prudent, the vessel may be allowed to ride to it; but in that case the line should not be made fast right forward, for fear of bringing her bows on to the sea, when she might possibly be canted on to the other tack again. This procedure is bound to answer. The loss of the mast itself will assist her in falling off, and it is better to lose one mast than risk losing all by remaining on the wrong tack and getting brought aback.* But in such an extreme emergency as this all will depend on the thorough seamanship of the master, who will want no book to guide him. It is only with the utmost difficulty that any work can be proceeded with when actually caught in a bad cyclone, but many seeming impossibilities can be overcome when it becomes a matter of life or death.

When scudding, if there is no hood or protection over the wheel, compel the helmsmen to make themselves fast, and strictly order them not to look aft. As a rule, seamen, from some stupid idea—possibly that it is lubberly—will not secure themselves when at the wheel, unless forced to do so; but if a man knows he has hold of something, in case the ship is "pooped" (*i.e.*, is over-run by a sea), it gives him confidence, and enables him to attend more coolly to his steering. Again, if a man is allowed to look round at the sea, he gets nervous, and begins to steer badly at once, thinking, in fact, of other things than what he is about.

Do not allow a bad steersman to remain at the helm under such circumstances as this; and if the gale is *exceptionally* heavy, and you have got a man at the wheel who is keeping her along nice and smoothly, it is better to let him stay there the whole four hours, if necessary, than to relieve the wheel at the usual time.

* In cutting away masts, always cut away lee rigging first, then weather-side, beginning aft, and the stays and foremast weather-shrouds together.

*When relieving the wheel, the steering should be most narrowly watched* till the fresh hand has got the run of her. A spare lamp should also be kept lighted, ready in case the binnacle lamp should blow out. From want of attention to these points many cases of broaching-to and getting by the lee have happened *at the change of the watch.* Sad accidents have also occurred several times on board of Atlantic steamers from the same causes.

A man turns up on deck, both eyes bunged up with sleep, and gets hold of the wheel spokes before his eyes are open. The officer of the watch, instead of being, as he should be, extra vigilant, is giving the orders to *his* relief. A careless piece of steering is the consequence, often with fatal results. In one of the best known Atlantic mail boats, only a few months after the writer of this article left her, the captain, chief, and second officers were all washed overboard together from the bridge *whilst the wheel was being relieved.* She steered from aft, the junior officer conning her at the time.

But now comes the question—When a ship is making bad weather scudding, and it is necessary to do something for her safety, is 'heaving-to' the *best* manœuvre? From a discussion initiated by one of the authors in the *Nautical Magazine* for 1895, it would appear that shortening sail, or scudding under bare poles, is after all the best method to adopt. In every case where it has been tried, success seems to have followed, and it appears that the more a vessel's speed is eased the better she behaves and the easier she steers; and, even when all canvas has been furled, if it is necessary to bring her to the wind, she will come-to better than if any sail was set. We therefore recommend this matter to the notice of our readers, and advise that when running before a heavy gale (in sail or steam), when the ship begins to make bad weather, *reduce her speed* as much as possible.

## SECTION XXI.

## ACCIDENTS TO SPARS, &c.

Braces are parted and spars sprung, as a rule, when the vessel is scending heavily. A sudden heavy scend puts a strain on gear all in a moment, and it is usually only a matter of moments if further damage is to be averted.

Bowsprit sprung.—This would probably happen with the vessel either close hauled or with the wind well abeam. Hard up the helm, let fly spanker sheet or peak halyards, weather crossjack braces, &c., and get the ship before the wind *at once*. The next thing to do is to secure the masts. If the forestays set up abaft the knightheads, the lowermast is all right; but if they are set up to the bowsprit, they must be cast adrift, and, if possible, rove in through the hawse-pipes and set up to the windlass. But before casting anything adrift reeve a full fall in two cat-blocks, pass a hawser doubled over the lower masthead, and set it up with the cat-fall to a strop passed round under the stem close in. The jib and topmast stays must be served the same way, taking care to parcel them all well in the nip. Now get the fore and main topgallant masts on deck, and send the jibboom in, and you may then fish the bowsprit.

Instead of passing the stays through the hawse-pipes, they may be passed under the bowsprit, just outside the knightheads (being well parcelled), and set up on their ends. The jib and topmast stays might be set up to a chain strop passed under the bobstay bolts in the stem, if strong enough.

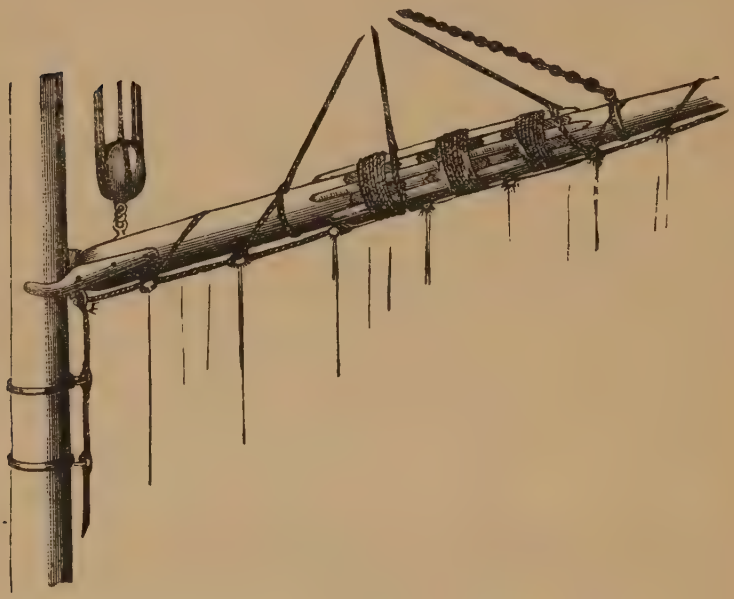
If the spring is not too bad, and the spar *well* fished, the two jibs and topmast staysail may be carried again, but it will be prudent to do without the flying jib, and keep the fore topgallant mast on deck for the remainder of the voyage, as so much depends upon the bowsprit that it is not wise to run any risks.

Lower Brace parted.—In these days of double topsails and iron yards damage seldom occurs from a lower brace parting; but should this accident happen running heavy, let run the lee topsail sheet, the tack of the course, and ease off the sheet. Keep the vessel dead before the wind, but mind that in the hurry she does not come by the lee.

Preventer braces are very valuable things when running heavy with a quarterly wind, and well repay the small extra work in reeving them.

If a yard is sprung by such an accident as this it must be fished

This is not a difficult operation, and a yard so treated will stand perfectly well. Gaffs can, if sprung or carried away, be secured in a similar manner.* *(Plate No. 70.)*



Schooner's main gaff fished.

*Plate No. 70.*

To fish a Yard.—Get sufficient small spars, shape them a little, that they may lay snug to the yard, place them round the yard, and fill in between them with chocks of wood, and then lash all together. The lashings should be of good small stuff, according to the size of the job. If the stretch has been taken out of it, all the better; if not, lay it on a stretch before using. When the lashings are hove as taut as possible, set them up still tauter by driving wedges under them, being careful the wedges do not cut the stuff. Then, supposing the yard is sprung in the quarter, it will be well to fit a preventer lift just outside the spring, and be careful to let both it and the standing lift take a strain

* A lower yard is most likely to be sprung in the quarter outside the truss band. It will probably be a small crack *along* the yard on the after or lower part.

If it be a gaff that is sprung, the peak halyards should be hooked to a crow-foot set of strops, the two inner legs of which should take the fish, and the two outer ones the gaff at each side of it. Such an accident as a yard-arm wrung off may, if not too big a job, be keyed. *(See Plate No. 71.)* This is better and neater than a scarf for such a purpose.*

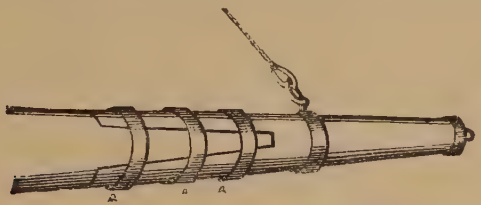


*Plate No. 71.*—Yard-arm keyed. *a. a. a.* Hoops.

STAY PARTED.—If a stay parts, keep the ship away and relieve the spar; send up a hawser, pass it round the masthead, and make a bowline knot in it with sufficient bight to form a large enough collar. Such a preventer stay will require a tackle kept on it for some days until the stretch is out of it.

If a topmast backstay carries away when by the wind, put the helm down, and let her come round; tack her if she will stay, if not, let her come round on her heel. Of course if it is blowing hard, with a high sea running, it will not be always practicable to resort to this manœuvre, in which case the topmast must be relieved as much as possible at once by taking in canvas, keeping the ship away, and bringing the wind on the other quarter.

Wire spans, or lengths of wire hawser, if such things are on board, are much better for preventer stays and backstays than rope. A large rope hawser used for this purpose is never done stretching, and will want careful attention for days.

LOWERMASTS GONE.—If so unfortunate as to lose the lowermasts, it is well to remember that a pair of sheers formed of light spars of good length will set a good sized square sail. The chief object in such a case will be to reach a port, and to this end the prevailing winds should be studied, as the vessel cannot work well to windward. A large 1,700-ton ship, that had to cut away her masts in the Bay of Bengal during a cyclone, having shifted her cargo and gone on her beam ends, made a port without much difficulty by using her spare topmast as a main mast, a pair of sheers as a fore mast, and a spare yard lashed to the stump of the mizzen mast for her mizzen mast.

* If you have plenty of good small chain on board, a fish may be lashed with this instead of rope. If it can be got well taut, there will be no stretch to it as in rope.

Book reading cannot do more than give hints as to procedure in cases of this kind; the seaman must learn by actual experience, and also be guided by the circumstances of the individual case.

A Wooden Ship's Stem started may be hove in place again thus:—Pass the two bower cables out through the hawse-pipes, and shackle them together outside the stem; parcel the stem well, get both chains taut, and heave on whichever cable will straighten the stem; when hove straight, heave in equally on both cables with the windlass till the stem comes back into its place.

A Choked Pump, which cannot be hove up on deck to be cleared, may sometimes be got clear (when the lower box is drawn) by dropping the lead down a few times with the line attached.

Topmast sprung.—If a topmast is sprung just above the lower cap it should be lowered till the sprung part is below the cap, cut another fid-hole, and shorten up the rigging, backstays and stays.

Lower Rigging worked slack in a gale.—Get a spar outside it on each side about a third of the way up from the deck, then frap them together across the ship with turns at every shroud. Wire rigging seldom requires this treatment.

Downhaul parted.—If a jib downhaul parts in *moderate weather*, keep the ship off a bit and send out three or four hands to the jib-stay and haul it down.

Footrope of Sail stranded.—Take a piece of rope as large as the footrope, make a knot in each end, seize this on the footrope with strong marline seizings, so that the stranded part comes in the middle of the stopper.

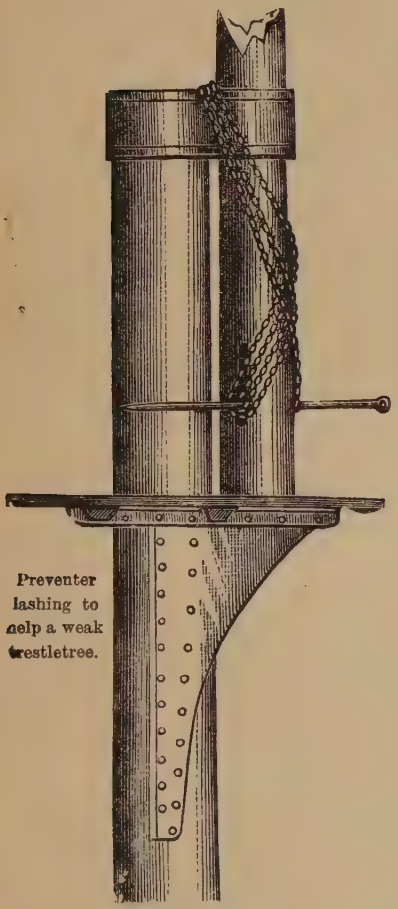
Hawse-pipe cracked.—Having ridden out a heavy gale, and the hawse-pipe is found to be badly cracked, the chain may be hove in by hanging a kedge anchor over the bows, close to the hawse-pipe, and, having secured it in this position, letting the cable lead over it whilst heaving in. This method may also be resorted to if it is noticed that the hawse-pipe is gone during the gale, as the kedge can be hove up to take the weight off the pipe, if opportunity is taken as the cable slacks.

Ship Driving on a Lee Shore.—The *last* resource is to cut away the masts, but in this case leave a lower mast standing if possible, as you may require it to secure the Life-saving Brigade's hawser to.

Lower Cap worked loose or cracked.—A cap worked loose may sometimes be tightened up by wedges; this will depend on the circumstances. If this cannot be done, the only thing is to put a lashing round masthead and topmast.

Take a length of good chain, a topsail sheet if you have nothing better, but a stouter chain is preferable; secure one end to the after side of the lower masthead if there is a suitable bolt there, now pass turns figure-of-eight fashion through the doublings, jerking each turn tight, heaving tight also with a capstan bar; get as many turns as possible, starting from below, and finish off with three or four frapping turns, which must be jerked and hove tight the same as the round turns. Secure well the end, and wedge up the lashing as hard as possible with good hardwood wedges entered from above.

TRESTLETREES SPRUNG OR WORKING DOWN.—Get a stout iron bar, such as an awning stanchion or a heavy crowbar, as large a bar in fact as you can get through the sheave hole in the heel of the topmast, which may be eased a little for the purpose. Reeve this bar through and fit a hardwood plug above the sheave to ease the strain on the pin. Take a length of good chain and pass *cross* turns over the out-hanging ends of the bar, and over the lower cap, passing the turns before the topmast, securing one end as a standing part, and setting up each turn with a tackle from the topmast head; pass good frapping turns and make fast. The turns should be kept close to the mast, *not out along the bar;* they may ride one over the other.



Preventer lashing to help a weak trestletree.

*Plate No. 72.*

Or a wire strop, as large as the sheave hole will take, may be fitted, one end shackled to the bolt in the cap, the other end set up and secured to the opposite side of the cap, but in this way you can only get one part of the wire to take all the strain.

PARRAL OF UPPER TOPSAIL OR TOPGALLANT YARD PARTED.—Get the sail aback, and for this purpose, if necessary, bring the ship to the wind. Do not start the sheets, but get the yard down on the lifts. If running in heavy weather and the topsail parral goes, keep the sail full, clap on the downhauls, and get the yard down on the lifts; the buntlines may then be unrove from the masthead and passed down abaft, but kept in the lizard, and used as guys to haul the yard to the mast. But mind, with an accident of this kind, to whatever sail it be, do not start the sheets.

If the weather-brace should go with the parral, it will be best, if possible, to get the wind on the other quarter, and lash the yard for the time being to the lee topmast rigging, and steady tight the topsail brace. This will keep the yard moderately quiet till you can repair the damage.

JIB-STAY PARTED.—Keep the ship dead before the wind, and lay the fore yard square; the sail can then be easily taken in, as it will lie becalmed.

LOWER TRUSS CARRIED AWAY.—A very rare accident in these days. Keep dead before the wind, up mainsail and steady well taut the braces. Up with two stout luff tackles, place the outer blocks well out on each quarter of the yard, and lash the inner blocks to the fore part of the mast, then heave both tackles taut; this will steady the yard whilst you repair the truss. The ship can now be brought to her course again.

JIBBOOM CARRIED AWAY.—Heave the ship to or you will be unable to get the wreck aboard, and the broken boom might go through the bows before you could clear away the wreck.

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## SECTION XXII.

## LEAKS.

Leaks may be the result of many causes, the chief of which are collisions and strandings in iron vessels; but, in a vessel of wood or iron, bad construction or old age may cause leakage sufficient to sink the ship.

Leaks from these last causes usually begin in a small way, and we will treat of them first.

When a vessel begins to leak, the thing of greatest importance is to

find where the water is coming in. If this can be done, means may be taken to stop it.

An old wooden vessel will be most likely to begin to leak first at the hood ends, fore and aft, or at the butts of the planking. It is usually possible to get down the fore peak, and this part should be carefully examined. The after ends can also usually be got at in the same way.

Occasionally a thrummed sail may be of use if the leak is at the fore end, but elsewhere this method will not be of much value, as the vessel's way through the water will not keep it to the side of the hull.

Supposing a leak can be got at, and is in the planking of the ship, it can be stopped by shaped pieces of wood let in between the timbers, and chintzed round with oakum; but in a case of this kind great care must be taken not to force the planking away from the timbers by using undue force.

If an iron sailing vessel begins to leak from age, it will usually be found in the way of some pipe, such as a head force-pump pipe. These are sometimes flanged through the bottom with a brass or copper flange, and have been known to cause corrosion, make a large hole in the plate, and cause the vessel to founder, through the collision bulkhead being *also* faulty, and letting the water run right into the ship.

A ragged hole such as this would be must, if possible, be stopped from inside in a similar manner to that just mentioned for a wooden vessel, namely, by laying shaped blocks of wood in between the frames, and chintzing them up, and, if necessary, tomming them down with shores.

Rivets occasionally get loose, and soon rust and cause a leak. Such a rivet must have the head cut off with a cold chisel, and be drifted out. The hole must then be plugged with a wood plug, if nothing better can be done. But occasionally a better job than this can be made of a ragged rivet hole as follows:—Take as large a cork as can be forced through the hole, tie to this a piece of twine, push the cork through, pay out twine, and let it float up to the surface; secure it, and pass a good piece of marline in place of the twine. Now get a threaded bolt, with a good head to it. Cut a square patch of iron of sufficient size. It should not, however, be much larger than three or four inches square. Drift a hole in the centre of this the size of the bolt, cut a piece of good thick rubber or packing of the same size, pass the bolt through, and secure them with twine close out to the head of the bolt. Now pass this overboard on the marline, and haul the bolt into the hole. Have a good large square washer and nut for the inside, put plenty of

red lead in, screw up tight, and your leak is sufficiently stopped for as long a voyage as you like. This is now an old experiment, and has been often tried with complete success.

In a case of collision the leak is either above water, in which case something can be done, or else it is below water, and it may be necessary to abandon the vessel at once, unless it is in a small compartment, and the bulkhead stands. Prompt action is necessary, if anything *is* to be done. Send down at once and see that no water-tight doors are open in any bulkhead. See the pumps are set going connected with

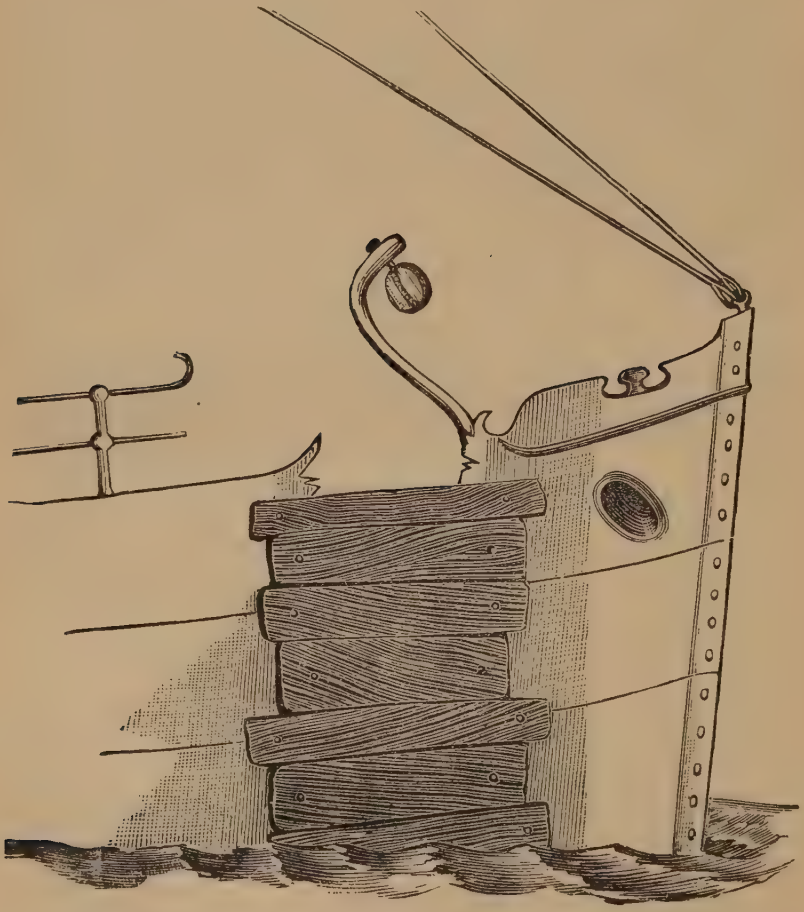

*Plate No. 73.*

Temporary repairs to bow of the s.s. B———n, after collision.

the compartment the leak is in, and shore up the bulkhead, if it is to be got at. Stop the engines, if a steamer, and get the boats out. But in the very first instance take a few of the best men and get to the leak. If the inrush of water can be stopped *by any means*, then something can be done. Now the only available thing for this, unless a patent stopper is on board, is a sail, and in choosing one remember that no small jib or staysail will meet the case A topsail with a reef in it will be the best; and if this can be got over the place, and secured up and down inside with the reef points, it may be possible to keep sufficient of the rush of water out to enable the crew to work. If so, proceed at once to drift out a rivet here and there on each side of the rent. Let the carpenter roughly measure off and cut pieces of planking (solid hatches will do, if nothing else be available, and they are broad enough) to go across the hole, with an auger hole bored in each end for a bolt to go through. These auger holes must fit to some of the rivet holes you have drifted out. Get some long bolts, with threaded ends, and bolt on these pieces all the way up and down *outside* over the rent, beginning at the bottom. The circumstances of the case will determine the neatness of the work. Felt or tarpaulin may sometimes be used to fill in. The sail must remain in its place, and the bolts must go through it. Now get cement, if you have any on board, and build up a solid block of it inside. If this is not obtainable, shift must be made to chintz up the crevices inside as well as possible without it. The difficulty will, of course, be with that part which is under water; but however rough the work, if the great rush of water can be kept out, something may be done for the vessel. If she can be kept afloat, and the pumps can prevent her sinking deeper in the water, she may be listed over and the whole rent brought out of water, in which case a better job may be made.

In all cases of ordinary leakage it should be remembered that *the ship should not be given up till she shows evident signs of foundering.* It will sometimes be found that when the water has got to a certain height it stops gaining, and the pumps are able to keep it at that level. This fact will explain itself to those versed in hydrostatics, but it will here be sufficient to say that it depends on the depth below the surface how much water a hole will admit in a given time; and that when water has risen to a certain height in the hold above such a hole it exerts a pressure which prevents so much water entering as it did when the hold had nothing but the cargo in it. Ships may have been abandoned in too much haste for want of this knowledge.

In a steamer the water will, of course, if possible, be let run into the

engine-room bilges, and the water used for injection, with engines full speed, the donkey pumps being also set on to the hold where the leak is. Most first-class ships are, in addition, provided with centrifugals for emergencies of this kind.

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## SECTION XXIII.

## SAILING SHIP ON FIRE.

Say you are out on the open ocean, and that no assistance is available.

Let an officer with a couple of hands at once go below, and, if possible, find out the seat of the fire.

Whilst this is being done, heave the ship to, clew up all the sails, and stow them, commencing with the courses first, for it is a generally admitted fact that the less way a vessel has upon her the less draught she will make in her hold to fan the fire.

If it is found impossible to get at the seat of the fire, or find out its exact locality to a certainty, then batten down all hatches, ventilators, scuttles, and deck openings, and try to smother the fire out, keeping the ship lying under bare poles.

At the same time get all your boats ready to lower at a moment's notice, and provision them.

You will soon ascertain if the fire is likely to smother itself out, by watching the internal heat in the ship, by boring a small hole in the deck large enough to admit of a thermometer being lowered through it into the hold, keeping a piece of wet waste round the line of the thermometer to prevent any air getting down. If you find the internal heat in the ship is getting less, you may conclude the fire is dying out. But keep the ship lying to under bare poles for several hours before making sail.

But if you find the heat is increasing, take four pieces of wood about one foot in length and six inches in depth, and nail them securely to the deck in the form of a square. In the middle of this square bore a hole with a one-inch augur through the deck; keep this square continually full of water, so that no air can get into the hold whilst the water is running down. Keep on thus for several hours till you think the cargo is well saturated with water.

Try this manœuvre in several places about the deck if you are doubtful about the position of the fire, but when changing places be

sure and plug up the old holes before leaving them. Two men drawing water can easily keep a one-inch hole continuously full of water.

If you have a force pump with a copper nozzle, then cut one of such holes as mentioned above large enough to admit of the nozzle fitting tight in it, and keep the pump going *continuously* till the cargo is saturated. If this fails there is yet left one alternative to save the vessel, and it is well worth trying if the fire is gaining ground, and especially so if you are sure the fire originated at the bottom of the cargo. If otherwise, and you are persuaded the fire is situated on top of the cargo, the directions below are of no service.

But we will assume it is *moderate weather*, and the fire is situated at the bottom of the cargo, gaining ground fast, and that the boats are all ready to save life.

If she is a wood-built ship, a hole must be bored in the fore peak or in the after run of the vessel with a large augur. Directly the hole is made, a long *tapered* staff, very small at the lower end, must be inserted in the hole, and eased up as required; then let a few feet of water run into the vessel, but not enough to endanger her safety, and plug the hole up with the staff.

If she is an iron vessel, then drift out a large rivet at whichever end of her the water will get quickest at the fire, and use the same means as mentioned above to plug up the hole when a sufficient quantity of water is in the vessel.*

Many of our large sailing ships now-a-days have an engine on board. If fire happened on board such a vessel, then, as quickly as possible, get a pipe or scalding-down hose led from some of the boiler connections down into the hold, and keep forcing steam into the hold as fast as possible; this in all probability would exterminate the fire sooner than any of the means quoted above, as it is now a pretty well known fact that steam will extinguish fire sooner than water in confined spaces.

If all the means quoted have failed, then the ship is doomed; get the boats out in time, and have them alongside, but when once the fire bursts through the deck or hatches, all is lost, and the sooner the boats shove off the better.

Before leaving the vessel, if there is any powder on board throw it

* Captain Jackson, of the American ship *John Kay*, finding his cargo on fire, had augur holes bored along the weather side as low down as possible, then put his ship on the other tack and submerged them. When enough water had run in to extinguish the fire, the ship was again put on the former tack, and the holes plugged up. The fire was successfully put out; but we think that holes made from inside are safer, and that the way we suggest is the best.

overboard, but keep a few rockets in each boat, as they are very handy in one boat signalling to another at night time if they get parted. Do not leave the vicinity of the vessel whilst she is burning; she is a good beacon, and will attract any vessel which may come within sight of her, thus giving you a better chance of being picked up.

These directions are all under the head of fine weather, but it may unfortunately happen that the vessel is found to be on fire in very bad weather. If such is the case it is very hard to be able to advise what is best to be done under such trying circumstances to save the vessel, but I think the most prudent course to adopt would be to at once rig a sea drogue or anchor, clew up the sails and stow them. If the fire was aft in the vessel, heave the drogue overboard forward, and ride by it. But if the fire was forward, then heave the drogue overboard aft, and ride by it with a bridle hawser on each quarter, keeping the helm amidships, with the fore topmast staysail set, with sheet amidships. If this was done, and it was a good drogue, the ship would tend the sea very kindly. This would ease the draught below considerably, the ship would lie quiet, and all hands could work well at the fire, and not be broken off as they would be otherwise to tend the sails.

NOTE.—Under ordinary circumstances, and with hatches, &c., open, it is true enough that the draught below deck goes against the wind, but nevertheless, it would not do to act on this law, and ride the vessel by the stern if the fire was aft; for if you did so, and it once broke through, the vessel would be a mass of flame in no time, and considering that all hatches, &c., are closed, there will be no back draught to be worth consideration.

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## SECTION XXIV.

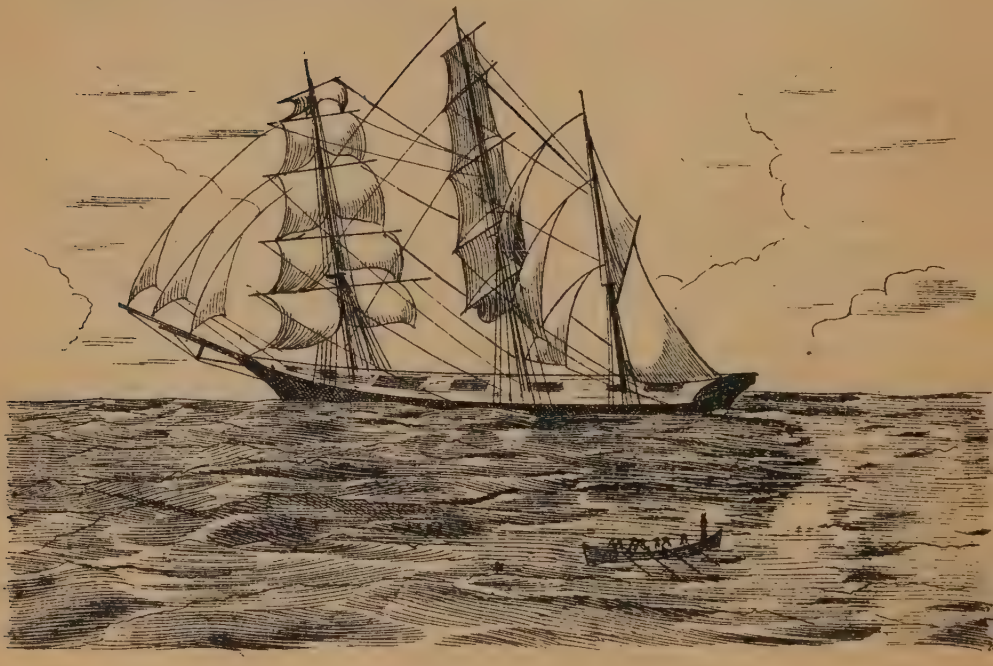
## MAN OVERBOARD.

Always make some attempt to save a man overboard. It is better to chance losing a sail, by throwing her up in the wind, than make no effort at all. It is sad to have to say so, but, notwithstanding the life-saving appliances clauses in the Merchant Shipping Act, boats in ordinary steamers and sailing ships, *are seldom, if ever,* "at all times fit and ready for use." A boat lashed down in chocks having standing hinges, with the davit falls coiled into the boat, and the covers laced on over all, can scarcely be said to be "ready for use," as required by the Act; with the result that twenty minutes is no uncommon time to elapse before a boat reaches a man in the water. If it were the universal rule to keep a boat slung out and fitted with some lowering or disconnecting apparatus, many a man would now be alive who has been sacrificed to this grossly careless custom.

*Plate No. 74.*

MAN OVERBOARD—RUNNING FREE.

*Plate No. 75.*



MAN OVERBOARD—CLOSE HAULED.

Lifebuoys are often carried after they are useless: to heave such a thing to a drowning man is like throwing a holy-stone at him.

FIRST ORDER: "Put the helm down!" "Turn the hands out!"

FIRST THING TO DO, *even if the man does not come up:* Heave overboard the handiest article you can get, *before you see him.* This marks the sea. If nothing else is at hand, throw the binnacle lamp overboard. This will effectually mark the sea with oil for a considerable time, and can be seen an immense distance from aloft. At night a Holmes' patent light will, of course, be hove overboard, if you have one.

*Send a hand aloft at once* to keep his eye on this mark, if the man is not visible, and direct the boat which way to pull. The further procedure will have to be considered with regard to the boat available.

In a sailing ship, if with a lee boat ready in the davits, and fitted with patent gear, man the boat at once, and lower her into the water before the vessel's way is stopped.

A life-buoy will, of course, have been thrown as near the man as possible.

Suppose the vessel going free, run the after yards forward, leaving the fore yards square, but have regard to the strength of wind, and right the helm in time to prevent her gaining sternway by flying-to too far. The vessel will come-to quicker this way than by running the fore yard forward. Sail must of course be shortened to meet the case, and the boat, if fitted as above, should be lowered before the vessel's way stops. (*Plate No. 74.*)

If on a wind, down helm and let her come round, getting the boat away, as before, before she loses her way, leaving the after yards square, and not touching the fore yards. Lying thus *she will drift towards the man;* but be careful not to lower the boat whilst she has sternway. (*Plate No. 75.*) If going about would give a weather side to the boat you are going to lower, of course do not do so. In such a case throw the ship aback, unless blowing too hard. If running in a moderate gale, the topgallant and upper topsail halyards should be let go, the helm put down, and the weather after braces slacked away, or, if thought best, the weather head braces. The yards will run forward of themselves as she flies to. But perhaps it is safest in so much wind to run the *head* yards forward.

If the boat is *not* fitted with patent gear, care must be taken in lowering her, the painter being passed up, and the boat not lowered till the most of the way is off the ship. *Coolness* in a time of excitement like this is of great importance to bring matters to a successful ending.

A boat carelessly lowered may capsize, and you then have seven or eight people in the water instead of one.

The great object should be to stop the ship's way and get the boat lowered as quickly as possible, and to get the vessel to drift back towards the man. Be careful not to lose sight of the boat. More than one instance of this has occurred. In one case known to the writer the boat was picked up by another vessel. In another and very sad case the boat, having an officer and two brothers, apprentices, in her, besides four others, was never again heard of.*

Do not give up a man overboard in heavy weather, if daylight, until some effort has been made to get the vessel back to the place where he fell overboard. With permission of a friend I here give an extract from an old log-book illustrative of this point:—

"Ship off the Mauritius 200 miles. Strong gale and heavy sea. "Under double reefed topsails and reefed courses, jib and spanker. "Whilst hauling the jib sheet aft a Lascar named Laloo fell overboard. "Ropes were thrown to him, but missed him. Wore ship off before the "wind (at 2 p.m.) and brought her to on the port tack. Kept a good "look out for the man, but saw nothing of him. Stood on on port tack. "At 3-30 p.m. wore ship to starboard tack. At 5 p.m. a man who was "aloft sang out, 'I see Laloo to leeward!' Kept ship off before the "wind, ran close up to the man and picked him up, all well, but much "exhausted, but he was all right an hour afterwards. He had been "swimming in a heavy gale of wind and heavy sea for three long hours."

In a steamer, if there are no reasons against it, hard a-port the helm and put her full speed astern. When ready to lower the boat, stop the engines until she is clear of the side, and do not give the vessel sternway until the boat is clear. If she is nearly stopped, and the back wash reaches to where the boat will enter the water, see that the bow tackle is unhooked first, unless the hooks are patents, in which case it will not matter. If you have been running before a strong breeze it will often be best to turn her round, keeping a good eye on the man in the water, and either tow the boat up to him or else not lower her till she can fetch him without pulling against wind and sea. If a man goes over in a heavy gale, and it is not too bad to lower a boat, make a lee for her and oil the water. If the ship has been going head on, it will sometimes be possible, by skilful management, to give the boat a lee nearly all the time she is in the water.†

* If too short handed to manœuvre the ship and clear away a boat at the same time, let go all the weather braces fore and aft, and run her into the wind.

† For further remarks on lowering boats see page 196

Though volunteers will generally be found to save life, *it is for the master to judge* whether it is wise to risk a boat's crew to save the man or not.

The best way to get into a circular life-buoy in the water is to keep both hands together and strike the buoy fair in the middle, it will then turn over your head. When fairly in it, keep your hands together, spread out your elbows, and let them rest on the sides of the buoy; you can thus keep better clear of the water.

A good way to manage a drowning man is to get round to the back of him, and clutch him by the arm, close up to the shoulder; you will thus be able to keep him up, and he will be unable to seize hold of you with either hand. The writer tried this with a heavy man, and found it to succeed admirably, and he was able to save him, though unable to reach a life-buoy, and having to wait what seemed a terribly long time for the boat to come up.

Unless your ship is disabled, and it is impossible to manœuvre, NEVER give a man up until you have made *some* effort to save him. Even if too rough to lower a boat, make an attempt to get the vessel back to him, and always heave a buoy over *first thing*, whether you see him or not.

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SECTION XXV.

## RAFT.

A raft made with a triangle of spars, and *casks* lashed inside them, is a machine quite out of date in these days, for in nine steamers out of ten such a thing as a *cask* would not be found on board, and in most sailing vessels they are a rarity.

If in such circumstances (very rare in these times) that it is necessary to construct a raft, the procedure must depend on the material at hand.

*Soft wood* spars should be chosen, as floating lighter than hard wood.

The best shape, possibly, is a long triangle in the shape of a capital V.

Suitable spars having been found and securely lashed, these may be planked over with smaller spars, hatches, or whatever may be obtainable; extra buoyancy may be given by the empty engine-room oil tanks, or drums, securely fastened; or if nothing better to hand, empty chests made as far as possible water-tight, of which a sort of bulwark may be formed.

An attempt should be made to rig the raft if possible. A pair of light

sheers, or a mast stepped well forward, towards the sharp end, can be contrived to carry a good-sized sail; and, unless anything better can be rigged, a pair of long oars, one lashed at each after corner, should steer the raft.

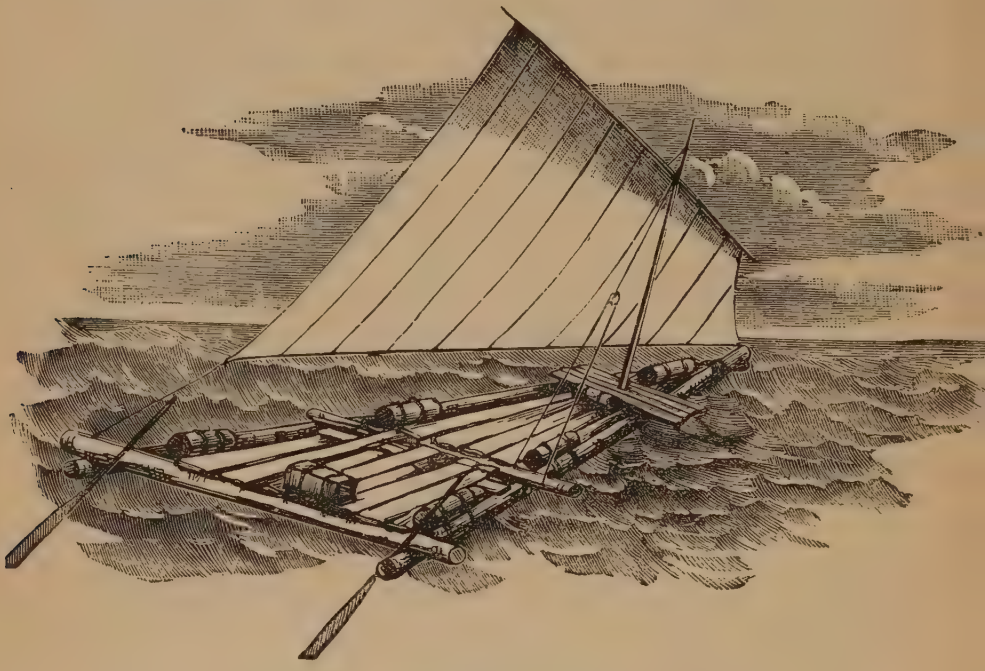

*Plate No. 76.*
Raft with empty oil tanks and drums.

Never forget that water is of greater necessity than food, and be sure to ship as much of this as possible in the time at your disposal.

For food, choose tinned meat and biscuit, not mixtures such as haricot mutton or lobsters, &c., but plain mutton or beef, as calculated to excite thirst less than more tasty mixtures.

If cast away in a warm climate, insist on all hands *thoroughly* wetting their *under* clothing in salt water at least twice a day.

If cast away in a severe, cold climate, it is well to remember that cod-liver oil, if any be on board, is a very valuable warmth-giver and food combined, and a good preventative against frost-bite. On one of our Arctic expeditions it was served out in spoonsful to the men, as long as it lasted, in lieu of grog. Remember that *snow* should *never* be taken to quench thirst, as it has the opposite effect; if first melted

it is all right. Ice, on the other hand, is a good thirst quencher. Snow rubbed on a frost-bite as soon as it is noticed will restore the affected part.

It is a judicious plan on the commencement of a voyage to let each officer know what he is to take with him in case of taking to the boats or a raft. For instance :—

Master—ship's papers, chronometer, and chart.
1st Mate—Sextant and blue lights.
2nd Mate—Compass and lamp.
Steward—*Fresh* provisions.
Carpenter—Water.
Engineer—Oil (very important).

A list made out on these lines might save much misery in many cases.

There is no reason why in an ordinary cargo steamer, as well as in a mail boat, every member of the crew should not be told off to a certain boat, and know where to go to in case of sudden emergency.

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SECTION XXVA.

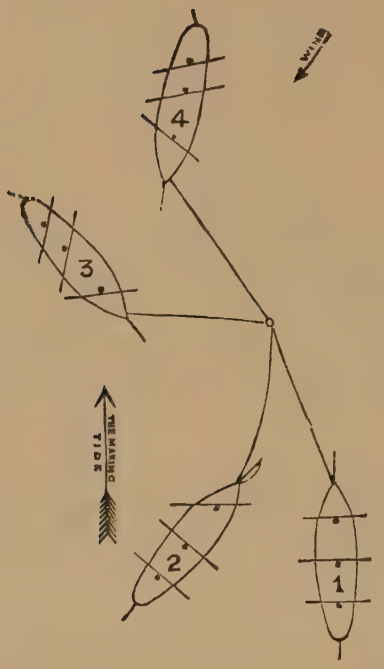
## SHIP AT SINGLE ANCHOR IN A TIDEWAY.

1

2

*(Plate No. 77.)*

1. Vessel sheered to a tide.
2. Same vessel having broken her sheer. The chain now lies right athwart the stem, and is in danger of fouling the stock and breaking the buried fluke out of the ground. If this happens she will drag, so have the other anchor ready. Shift the helm *at once*, and if the anchor holds, keep her where she is, if you can. If she will not lie there, be careful not to allow her to sheer over again violently, as she will start her anchor if she does so.




Tending to windward.

1—Vessel at slack water.
2, 3—Vessel swinging.
4—Vessel riding to the new tide.

*(Plate No. 78.)*

No. 2 has fore topmast staysail set, sheet to windward, and fore yard braced aback, helm steady.

No. 3 has hauled down the staysail, braced the fore-yard full and the after yards by, helm to port.

No. 4 rides to the new tide fore-yard full, and after yards by, helm to port.

In a sailing vessel it is necessary when anchored in a tideway to tend the vessel whilst at anchor.

The first thing to be done when the anchor is down, and the ship has got her chain, is to give her a sheer with the helm. Under ordinary circumstances it will be sufficient to secure the helm a little way over, and in a calm, unless for any *special* reason, sheer the vessel *away* from her cable. If a vessel is not sheered she will yaw about and probably start her anchor.

Occasionally, however, in a strong tide, with bad holding ground—such a place for instance as the Mersey—it is necessary to steer the

vessel the whole of the tide, to prevent her sheering violently about and dragging.

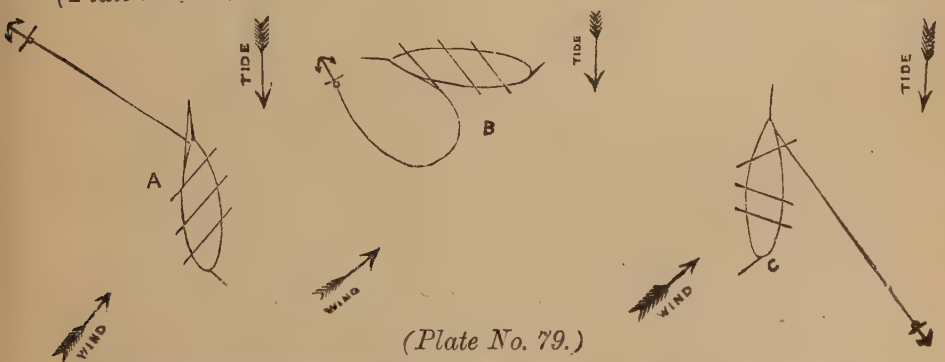
In ordinary circumstances the generally recognized rule respecting vessels riding at single anchor in a tideway is that a laden ship will lie best to windward, and a light ship to leeward of her anchor; but *all vessels*, whether light or laden, *should be kept to leeward of their anchor as long as they will ride so.*

A vessel should, if possible, be kept with a strain on her cable, and always shot the same side of her anchor at each change of tide.

The term "weather tide" means tide against wind; "lee tide" wind and tide together.

In a breeze it is best, when possible, to sheer a vessel to windward, especially if the wind is blowing direct athwart the tide, for by doing this a great part of the strain is taken off the cable. It is *not meant* that the ship should be kept *to windward of her anchor;* this would be found impracticable unless with a deep-laden vessel during the strength of a steady tide, and, as said above, a ship should be kept to leeward of her anchor as long as possible.

A vessel will occasionally, even if the greatest care is exercised, *break her sheer*, that is, drive over to the other side of her anchor, bringing the cable athwart the stem. When this accident happens she is in danger of dragging, for the tide taking her on the opposite bow forces her suddenly over, perhaps breaking the fluke of the anchor out of the ground, and possibly breaking the stock. Should this occur (*i.e.*, breaking the sheer) steady and shift the helm, and be ready with the other anchor if she begins to drag. If the helm is not shifted, and the anchor holds, she will drive back again violently, and without doubt start the anchor; keep her now where she is if possible. *(Plate No. 79.)*




*(Plate No. 79.)*

A. Ship riding on weather tide, helm to port, yards by. The wind has hauled aft and she should not lie thus, as she may break her sheer.

B. Same vessel having broken her sheer and run right over her anchor.

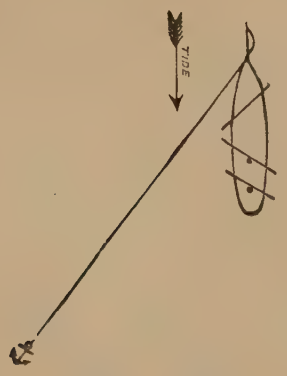
C. The ship having thus run over to the other side of her anchor, must be kept there during the strength of the tide by putting the helm a-lee, filling the after yards, and keeping the fore-yard by.

If anchored near another vessel, or close to shoal water, sheer the vessel *towards* the danger, then if the above accident should occur, and she began to drag, the tide would carry her clear.

Tending ship is much neglected generally in steamers, the possession of steam power giving them greater security, but many an anchor stock is broken because little care is exercised in these matters, and they are allowed to run over their anchors at slack water. Many a foul anchor is also the result of this carelessness.

At slack water great care must be exercised by the mate to prevent the vessel from dropping over the top of her anchor. He must, by manœuvring the yards, and with the help of a little canvas and the helm, so sheer or sail the vessel round her anchor as to keep the cable taut from the ship to the anchor till she tails round upon the new tide, keeping her as far removed from the anchor as possible while she is swinging; for if she drops over the top of her anchor the bight of the cable will most likely foul the upper fluke, pull it out of the ground, and cause the ship to drive, which in some cases may mean either doing serious damage to other vessels or your own, or perhaps the loss of the ship. Therefore it is incumbent on all mates of vessels to be on deck every time the ship swings, to manœuvre the yards, sails, and helm so that she keeps clear of her anchor.

This is *the* point aimed at in tending ship, and young seamen should endeavour to realize the importance of this duty.




*(Plate No. 80.)*

The diagrams here given will help the young student to understand the matter better, but he must remember that different directions of wind and different circumstances will necessitate different methods. A little careful thought will tell the mate what is best to do under the circumstances in which he may be placed. For instance, if the wind be stronger than the tide, the vessel in *Plate No. 80* would be

Then if she falls to leeward again, keep her there.

wind-rode and would not swing round to the other side of her anchor, but would probably lie with the wind on her quarter on the same side of her anchor as she was on the previous tide. But this is not an easy position, and she must be watched.

One of the difficult problems in tending a ship is when she is riding on a weather tide, and, through want of watching or other causes, she breaks her sheer. In such a case she must be kept where she has gone by putting the helm a-lee, bracing the after yards full, and leaving the fore-yard by. She may in these circumstances run right on top of her anchor unless steps are taken *at once*. Therefore, when riding thus she must be carefully watched, especially with a strong breeze, lest she should break her sheer and foul her anchor, or possibly break the cable. As soon as ever the tide eases, a ship in this position will require to be sailed round her anchor, to prevent this accident occurring. Perhaps it is as well, *during the strength of the tide*, to sheer a ship to windward *if she is laden*, as this will possibly prevent her breaking her sheer; but if in this position, she must be sheered to leeward *as soon as the tide eases*.

The art of tending ship at anchor is not to be learnt by book, but a careful reader of this article will have his thoughts set in the right direction, and will, by constant attention, learn in time how to manage a vessel in a tideway.

The young seaman should take every chance of gaining knowledge in practice by noting the methods used, and the *reasons* for using them, especially when in charge of a pilot, as these men are generally adepts at this science.

It is a matter for regret that the practice of buoying the anchor has almost died out. There is no doubt that an anchor *should* always be buoyed: it can then be seen where the anchor lies.

Remember that the old nautical phrase for a foul anchor was "The Seaman's Disgrace."

## OFFICERS' ANCHOR WATCH

Should, invariably, in open and exposed roadsteads, be kept by one officer and a seaman. The duty of the officer consists of seeing the vessel does not drive, by carefully observing the cross bearings of any land or lights that may be in sight on coming on deck; and, before going below, informing the officer who relieves him of the correct bearings. But whether there are any lights or objects in sight or not, the lead should be kept on the bottom with a slack line, so that it may be seen at once if the ship is driving.

This duty, in a valuable ship which carries three officers, should never be left to a seaman, for many a fine vessel has been lost through this cause.

The officer should also see the riding light is kept well trimmed, and burning brightly, and if a fog prevails, see the seaman rings the bell at least every two minutes. He should also frequently go forward if the ship is riding heavy, and watch and feel the chain, and give her a few fathoms more if required: when this has become necessary it will be wise to let the master know. He should also keep the yards well pointed to the wind, and if the vessel is likely to foul her anchor by passing over the top of it if she is in a tide way, he must hoist the fore topmast staysail, and sheer her clear of her anchor. He may also have to turn the yards round, or set the main topmast staysail for this purpose; if so, hands will have to be called to enable him to do so.

If the vessel seems likely to start her anchor, inform the master immediately. Do not wait till she starts it, for if she does, and it is not over good holding ground, nothing will stop her driving, if once the anchor flukes get fouled with sea-weed, &c., but a second anchor; so there is nothing like calling in time, as it may save a sea of trouble and anxiety of mind to the master.

In dangerous roadsteads, where the vessel is only anchored for a short time, it is best to keep the sea watch going, and this is commonly done in steamers.

The officer who has the last anchor watch, if going to get under weigh say at daylight, sees the cat and fish tackles overhauled all ready for action, the windlass gear all ready and in order, well oiled, &c., and the relieving tackles cast off the tiller, so that when all hands are called everything is in readiness to heave away.

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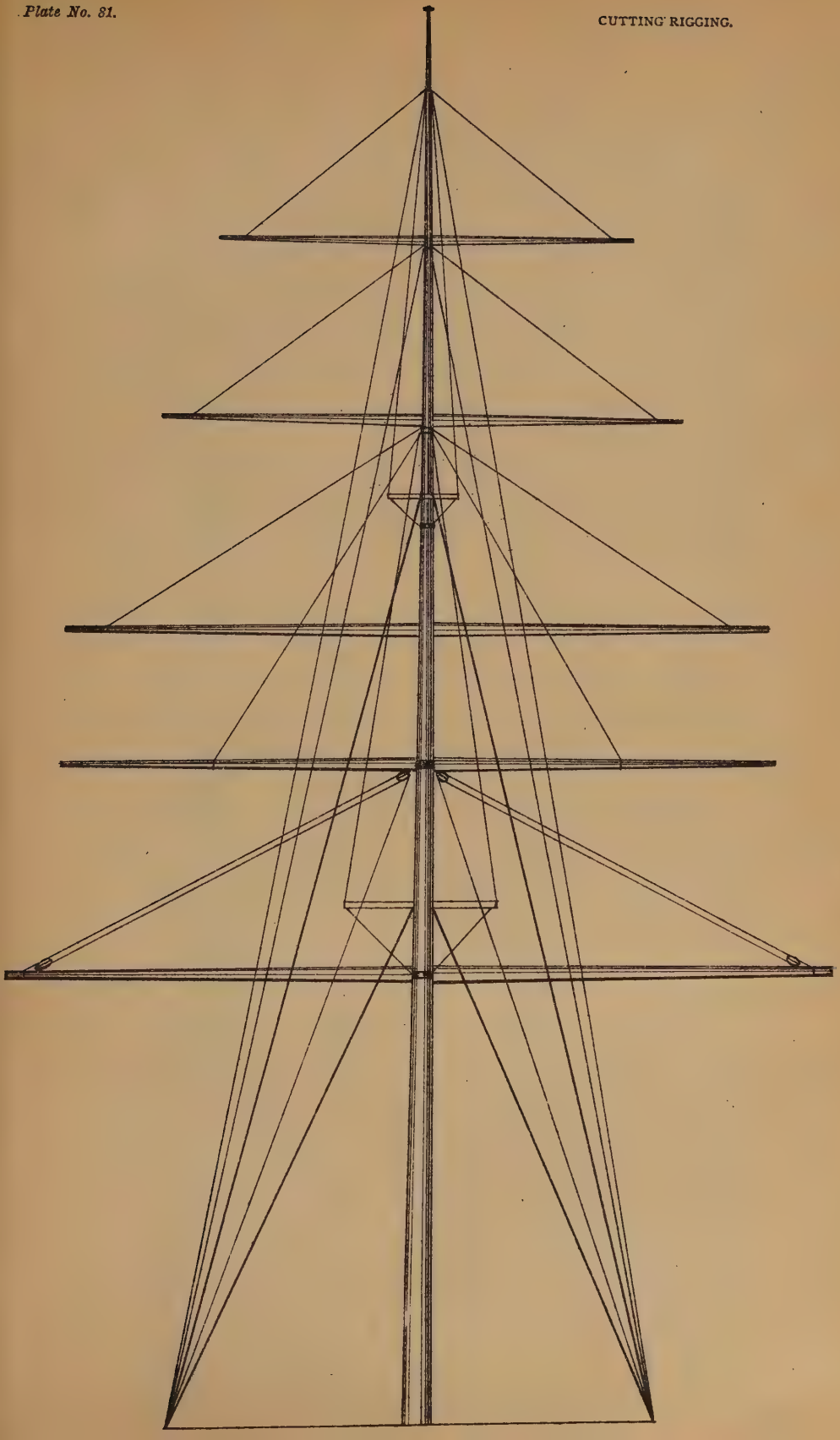
## SECTION XXVI.

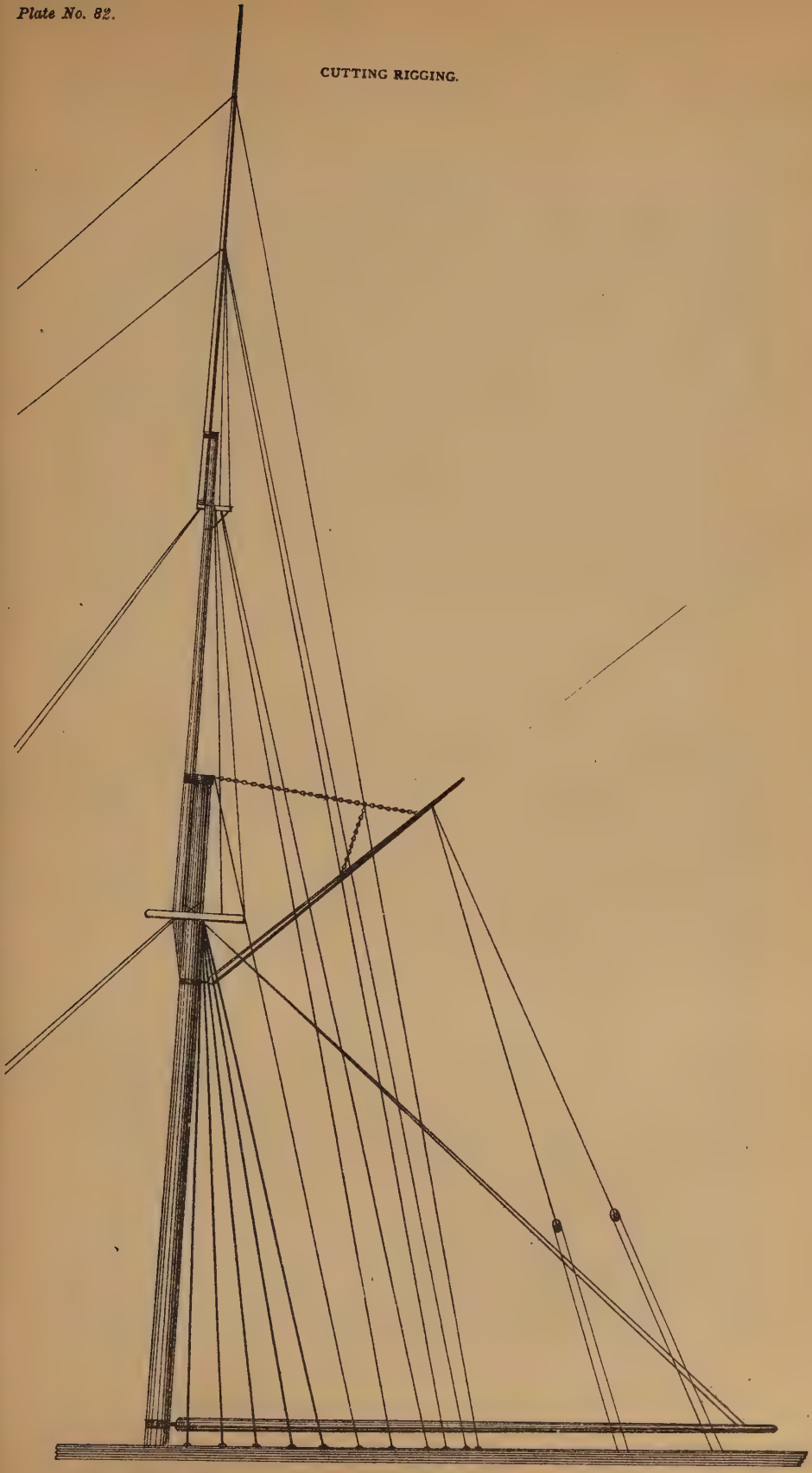
## CUTTING RIGGING.

*(See Plates Nos. 81 & 82.)*

When about to cut a set of lower rigging proceed thus: make two rough drafts of the ship with the masts fidded, one draft end on, or looking from right aft; this gives the spread of the shrouds athwartships. The other draft must be a broadside draft; this gives the spread of the shrouds fore and aft, and the carry aft according to the sheer of the ship.



CUTTING RIGGING.



Say you wish to know the carry aft of each shroud. Measure on the draft the length from the middle of the masthead, in the wake of where the rigging will be placed to where you wish the foremost dead-eye, then from the same spot on the masthead measure to where you wish the after dead-eye placed; the difference that exists in this measurement between the foremost and aftermost dead-eye, divided by the number of shrouds in the rigging, gives the carry aft of each respective shroud; or in plainer terms, the longer that each shroud will be as you work aft, and the less this difference will be in the length of the shrouds, the greater rake the mast has.

For the first pair of shrouds (which go on the starboard side), measure from the middle of the port side of the masthead to the foremost dead-eye, double this, add the carry aft, allow for splicing or turning in, and cut; this is allowing the wire is on a proper stretch, all ready for serving and splicing in the dead-eyes. Then measure from the middle of the starboard side of the mast to the foremost dead-eye, for the first pair of shrouds on the port side, allowing them to be the diameter of the rope longer than the starboard pair, and cut.

The starboard No. 2 pair are next cut, then the No. 2 port pair, and so on; one pair going over the masthead on the starboard side, the next on the port side, till all the shrouds are complete. And remember as you work aft, each pair of shrouds are the diameter of the rope used longer than the pair that preceded them—bear this in mind. When measuring off the rope use a good tape line, and mark your cuttings by seizing two good rope yarns round the rope, and cut between each yarn; this will prevent the rope unlaying itself at the cutting. Tally each pair of shrouds as you cut them with a strip of marked canvas, to prevent a mistake occurring when placing the rigging over the masthead. Lower rigging should first have a coat of tallow, then parcelling, then double service of amberline right up and down. The eyes have sometimes a third service, or are parcelled over all. A coat of white lead should go on under each seizing, and the seizings should be covered with canvas.

In fitting wire rigging to a wooden vessel of any age it is wise t cut the shrouds short, and give a good length of lanyard, and thus get more *give* in the rigging.

Fore and aft stays are not served over, owing to the hanks of stay sails travelling on them; the wire of stays thus goes rusty much sooner than that of the shrouds, and they require carefully looking after. Backstays, unless served right up and down, will be liable in time to carry away about the top end of the service. When unserved standing

rigging begins to show signs of rust, it is best to paint it with white lead; this will prevent any further accumulation of rust.

When seizing in the eyes of the rigging, leave plenty of room for the eyes to go over the masthead, so that the seizings will lie well down below the bolsters.

If you prefer it, you can measure each pair of shrouds separately from the draft; but if such is the case, your draft should be on a good workable scale, not anything less than a quarter of an inch to the foot; and bear in mind that the larger the scale is, the more exact you will be in the cutting and fitting of the rigging.

Topmast rigging is cut in the same manner, only the fore and aft topmast stays are generally fitted with two lashing eyes, that set up abaft the mast above the eyes of the rigging.

Topgallant and royal rigging is also cut in the same way, only the fore and aft stays are placed on the mast first, to prevent the eyes of the rigging slipping down over the hounds of the mast.

Riggers themselves are not very particular about the exact length of each shroud when splicing in dead-eyes on board of a ship, for by simply taking a few turns in or out of a shroud they get the dead-eye to the required position, and with wire rope this is the common practice.

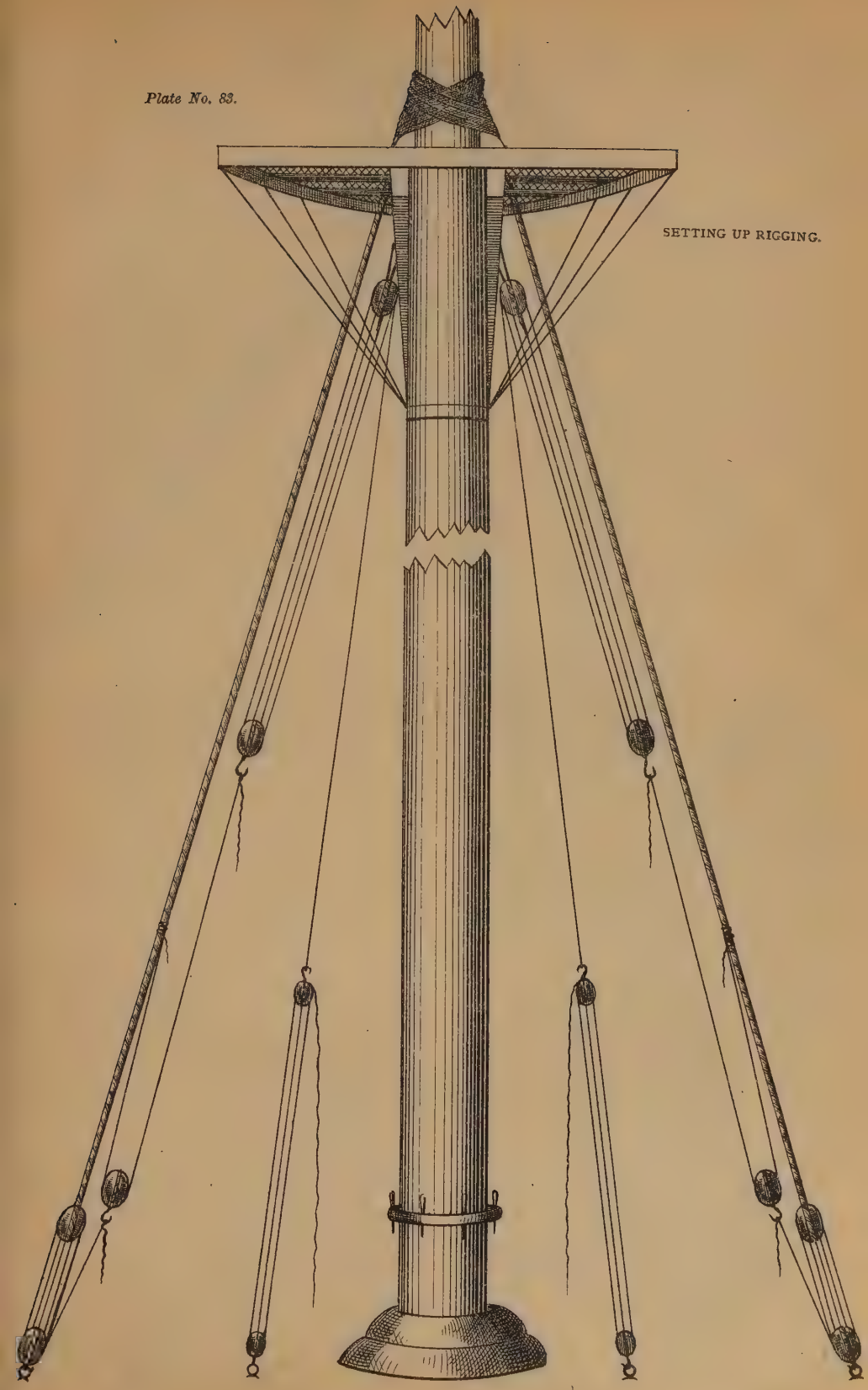
As to cutting lifts, foot-ropes, &c., and the running rigging, no special directions are necessary; they can be cut from the draft according to how they are to be fitted, there being many different modes of fitting them. Our advice is, in cutting running rigging, like buntlines, halyards, braces, &c., reeve them *first*, and cut them afterwards: much rope will be saved thereby.

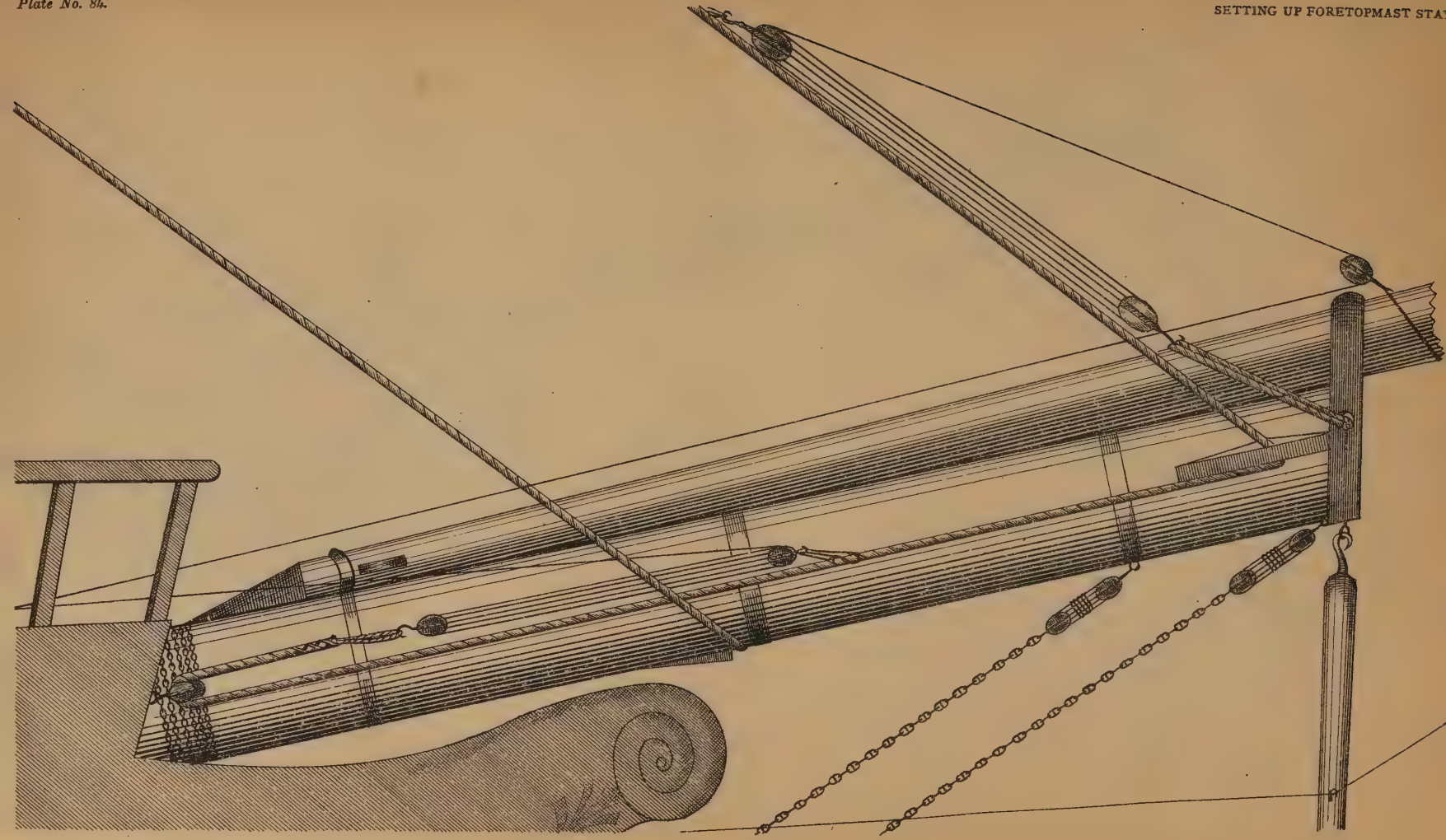
A great deal of the rigidity of wire rigging is counteracted by having the wire shrouds set up with rope lanyards, and vessels so fitted stand a less chance of getting dismasted than vessels that set up their rigging with screws, which are becoming much used in these days. In vessels *so* fitted there cannot be a particle of *give* in anything: and another objection to screws is, that to cut away the masts hurriedly would be impossible. And, perhaps more important still, the worms of the screws have been known *to strip* with the strain hove upon them by a heavy roll, and the vessel has been dismasted. Therefore, I think we may justly conclude that, of the two systems, the wire rigging with rope lanyards is to be preferred. (*See Plate No. 86.*)

Screws, no doubt, look neater than lanyards, and the rigging is more easily set up by them; yet we must not lose sight of the fact, that in

*Plate No. 83.*

SETTING UP RIGGING.





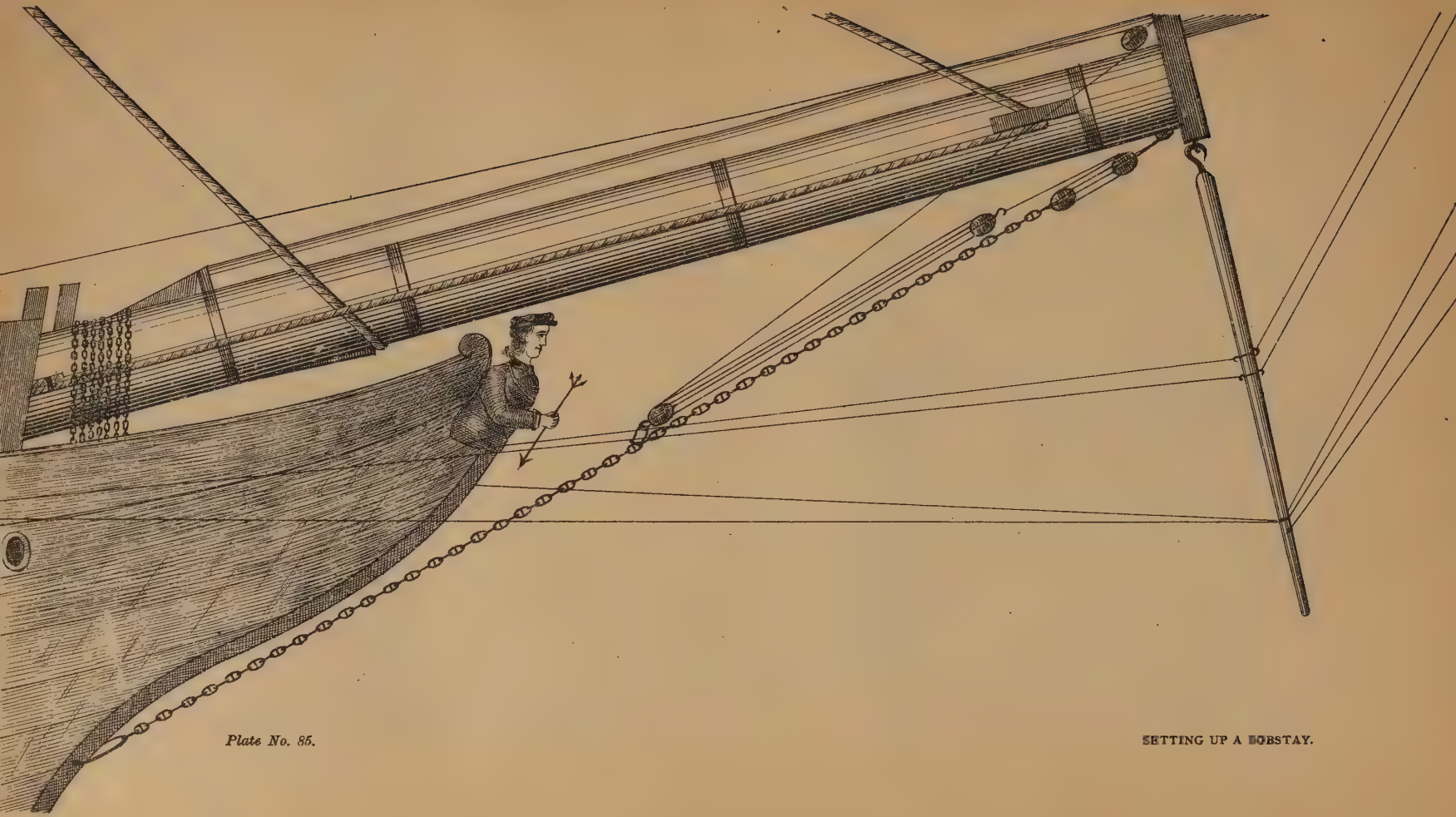


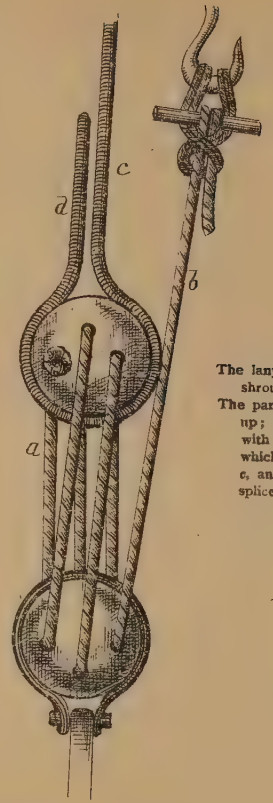
*Plate No. 85.*

SETTING UP A BOBSTAY.

*Plate No. 87.*

Wire rigging fitted with Shackles to masthead.

*Plate No. 86.*




REEVING A LANYARD.

The lanyard is rove with the knot under the end part of the shroud, because

The part (*a*) of the lanyard bears little or no strain in setting up; it and the next part having to be rendered through with a spike. Thus the principal strain is on the part (*b*), which brings the strain on the standing part of the shroud *c*, and not on the end part *d*, which would probably be spliced in, and thus be the weaker part.

heavy weather, with a laboursome cargo, their safety is not to be depended on, and these screws have been the means of splendid ships of the present day losing their masts through stripping, as aforesaid.

At the same time, screws have their advantages in this way. With the tremendous weight of top hamper in large modern sailing ships, it is a matter of difficulty (especially with new rigging) to keep the slackness out of the shrouds and backstays; and a shipmaster has informed us that, on one occasion when he took a new four-master away, and met with a long spell of heavy weather, he fully believes that had he not been fitted with screws, and thus able to set up his shrouds with expedition, he would have lost his masts; for it must be remembered that to set up a lanyard it is necessary to reeve purchases, and go through a greater amount of labour than would perhaps be possible in a short-handed vessel, in a long-continued gale of wind: and here screws would certainly seem to have an advantage. On the other hand, some shipowners who have adopted them in years gone by have returned to dead-eyes and lanyards.

In setting up the lower rigging the masts are first stayed; the stays being secured, the rigging is then set up, foremast shrouds first. Whilst setting these up keep an eye on the mast-coat, to see that one side of the canvas does not get all the strain. *(See Plate No. 83.)*

In reeving a lanyard in a dead-eye, the knot must be rove in the hole under the end part of the shroud; the hauling part will then be under the main part of the shroud, which will thus get the principal strain when setting up. The accompanying table gives the proper sizes of shrouds and lanyards. In all cases with wire rigging the lanyard should be at least the size of the rigging.

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* The writer, during the commencement of his first voyage to sea had this experience, the ship had lanyard rigging. Boats' oars were placed outside the rigging and parallel to the sheer pole and about 10 feet above it, which kept the seamen working clear of the seas coming aboard. Ratline ropes were then passed round the oars, port and starboard sides alternately and across the vessel's deck, and these were hauled taut as the vessel rolled.

## Table of Sizes and Tests for the STEEL WIRE STANDING

| REGISTER TONNAGE UNDER DECK. | Tons. 3000 and under 3500 | | Tons. 2600 and under 3000 | | Tons. 2300 and under 2600 | | Tons. 2000 and under 2300 | | Tons. 1800 and under 2000 | | Tons. 1600 and under 1800 | | Tons. 1400 and under 1600 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PLATING NUMBER. | 32000 and under 36000 | | 29000 and under 32000 | | 26600 and under 29000 | | 24200 and under 26600 | | 22500 and under 24200 | | 20700 and under 22500 | | 18800 and under 20700 | |
| | No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. |
| Fore & Main Shrouds ... ... | 6 and 2 cap | 5½ | 6 and 2 cap | 5¼ | 6 and cap | 5 | 6 and cap | 4⅞ | 6 and cap | 4¾ | 6 and cap | 4½ | 6 and cap | 4¼ |
| ,, ,, Chain plates ... | | 2¾ | | 2⅝ | | 2½ | | 2⅜ | | 2¼ | | 2⅛ | | 2 |
| ,, ,, Dead-eyes ... ... | | — | | — | | — | | — | | 12×7 | | 11½×6½ | | 11×6 |
| ,, ,, Lanyards (hemp)... | | — | | — | | — | | — | | 6 | | 5¾ | | 5½ |
| ,, ,, { Rigging Screws Diameter at bottom of thread } | | 2¼ | | 2⅛ | | 2 | | 1⅞ | | 1⅞ | | 1¾ | | 1¾ |
| ,, ,, { Rigging Screws Diameter of Pins. } | | 2 | | 1⅞ | | 1¾ | | 1⅝ | | 1⅝ | | 1½ | | 1½ |
| ,, ,, Topmast backstays | 3 | 5½ | 3 | 5¼ | 3 | 5 | 3 | 4⅞ | 3 | 4¾ | 3 | 4½ | 3 | 4¼ |
| ,, ,, Topgallant backstys | 2 | 4¼ | 2 | 4⅛ | 2 | 3⅞ | 2 | 3¾ | 2 | 3½ | 2 | 3¼ | 2 | 3 |
| ,, ,, Lower stays ... | 2 | 5½ | 2 | 5¼ | 2 | 5 | 2 | 4⅞ | 2 | 4¾ | 2 | 4½ | 2 | 4¼ |
| ,, ,, Topmast stays ... | 2 | 5½ | 2 | 5¼ | 2 | 5 | 2 | 4⅞ | 2 | 4¾ | 2 | 4½ | 2 | 4¼ |
| ,, ,, Topgallant stays ... | | 4¼ | | 4⅛ | | 3⅞ | | 3¾ | | 3½ | | 3¼ | | 3 |
| Mizzen Shrouds ... ... ... | 5 and cap | 4½ | 5 and cap | 4⅜ | 5 and cap | 4¼ | 5 and cap | 4⅛ | 5 and cap | 4 | 5 and cap | 3¾ | 5 and cap | 3½ |
| ,, Topmast backstays ... | 3 | 4½ | 3 | 4⅜ | 3 | 4¼ | 3 | 4⅛ | 3 | 4 | 3 | 3¾ | 3 | 3½ |
| ,, Topgallant backstays ... | 2 | 3¼ | 2 | 3⅛ | 2 | 3 | 2 | 2⅞ | 2 | 2¾ | 2 | 2½ | 2 | 2¼ |
| ,, Lower stays ... ... | 2 | 4½ | 2 | 4⅜ | 2 | 4¼ | 2 | 4⅛ | 2 | 4 | 2 | 3¾ | 2 | 3½ |
| ,, Topmast stays ... ... | 2 | 4½ | 2 | 4⅜ | 2 | 4¼ | 2 | 4⅛ | 2 | 4 | 2 | 3¾ | 2 | 3½ |
| ,, Topgallant stays ... ... | | 3¼ | | 3⅛ | | 3 | | 2⅞ | | 2¾ | | 2½ | | 2¼ |
| Bobstay Bar ... ... ... | | 4⅛ | | 4⅛ | | 4 | | 3⅞ | | 3¾ | | 3⅝ | | 3½ |
| ,, Pin ... ... ... | | 3⅛ | | 3⅛ | | 3 | | 2⅞ | | 2¾ | | 2⅝ | | 2½ |
| ,, Chain ... ... ... | | 2 1/16 | | 2 1/16 | | 2 | | 1 15/16 | | 1 14/16 | | 1 13/16 | | 1 12/16 |
| Bowsprit Shrouds (Chain) ... | 2 | 1⅛ | 2 | 1⅛ | 2 | 1 1/16 | 2 | 1 1/16 | 2 | 1 | 2 | 1 | 2 | ⅞ |

1.—The above requirements are intended to apply to vessels in which the dimensions of the masts and yards are such as would not be deemed unusual for vessels of the respective tonnages.

2.—Where four masts are adopted instead of three, the tonnage of the vessel may be reduced one-fifth, and where five masts are adopted, one fourth, in obtaining the sizes of Rigging, &c., from the above table.

3.—Where pole masts are adopted in vessels requiring one cap shroud only, an additional cap shroud is to be fitted, when the number of lower shrouds may be correspondingly reduced.

4.—Where double topgallant yards are to be adopted, a topmast cap backstay should be fitted in addition.

# RIGGING, &c., OF SAILING SHIPS.

| Tons. 1200 and under 1400 | | Tons. 1000 and under 1200 | | Tons. 800 and under 1000 | | Tons. 700 and under 800 | | Tons. 600 and under 700 | | Tons. 500 and under 600 | | Tons. 400 and under 500 | | Tons. 300 and under 400 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16800 and under 18800 | | 14800 and under 16800 | | 12700 and under 14800 | | 11600 and under 12700 | | 10300 and under 11600 | | 9000 and under 10300 | | 7700 and under 9000 | | 6100 and under 7700 | |
| No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. | No. | Size. Inch. |
| 6 | $4\frac{1}{8}$ | 6 | 4 | 5 | $3\frac{3}{4}$ | 5 | $3\frac{1}{2}$ | 5 | $3\frac{1}{4}$ | 5 | 3 | 4 | $2\frac{3}{4}$ | 4 | $2\frac{1}{2}$ |
| and cap | | and cap | | and cap | | and cap | | and cap | | | | | | | |
| | $1\frac{7}{8}$ | | $1\frac{7}{8}$ | | $1\frac{3}{4}$ | | $1\frac{3}{4}$ | | $1\frac{5}{8}$ | | $1\frac{3}{8}$ | | $1\frac{1}{4}$ | | $1\frac{1}{4}$ |
| $10\frac{1}{2}\times6$ | | $10\times6$ | | $9\frac{1}{2}\times5\frac{1}{2}$ | | $9\times5\frac{1}{2}$ | | $8\frac{1}{2}\times5$ | | $8\times5$ | | $7\frac{1}{2}\times4\frac{1}{2}$ | | $7\times4\frac{1}{2}$ | |
| | $5\frac{1}{4}$ | | 5 | | $4\frac{3}{4}$ | | $4\frac{1}{2}$ | | $4\frac{1}{4}$ | | 4 | | $3\frac{3}{4}$ | | $3\frac{1}{2}$ |
| | $1\frac{5}{8}$ | | $1\frac{5}{8}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ | | $1\frac{3}{8}$ | | $1\frac{1}{4}$ | | $1\frac{1}{8}$ | | $1\frac{1}{8}$ |
| | $1\frac{3}{8}$ | | $1\frac{3}{8}$ | | $1\frac{3}{8}$ | | $1\frac{3}{8}$ | | $1\frac{1}{4}$ | | $1\frac{1}{8}$ | | 1 | | 1 |
| 3 | $4\frac{1}{8}$ | 3 | 4 | 2 | $3\frac{3}{4}$ | 2 | $3\frac{1}{2}$ | 2 | $3\frac{1}{4}$ | 2 | 3 | 2 | $2\frac{3}{4}$ | 2 | $2\frac{1}{2}$ |
| 2 | $2\frac{3}{4}$ | 2 | $2\frac{5}{8}$ | 2 | $2\frac{1}{2}$ | | $2\frac{3}{8}$ | | $2\frac{1}{4}$ | | $2\frac{1}{8}$ | | 2 | | $1\frac{3}{4}$ |
| 2 | $4\frac{1}{8}$ | 2 | 4 | 2 | $3\frac{3}{4}$ | 2 | $3\frac{1}{2}$ | 2 | $3\frac{1}{4}$ | 2 | 3 | 2 | $2\frac{3}{4}$ | 2 | $2\frac{1}{2}$ |
| 2 | $4\frac{1}{8}$ | 2 | 4 | 2 | $3\frac{3}{4}$ | 2 | $3\frac{1}{2}$ | | $3\frac{1}{4}$ | | 3 | | $2\frac{3}{4}$ | | $2\frac{1}{2}$ |
| | $2\frac{3}{4}$ | | $2\frac{5}{8}$ | | $2\frac{1}{2}$ | | $2\frac{3}{8}$ | | $2\frac{1}{4}$ | | $2\frac{1}{8}$ | | 2 | | $1\frac{3}{4}$ |
| 5 | $3\frac{1}{4}$ | 5 | 3 | 5 | $2\frac{7}{8}$ | 5 | $2\frac{3}{4}$ | 4 | $2\frac{5}{8}$ | 4 | $2\frac{1}{2}$ | 3 | $2\frac{3}{8}$ | 3 | $2\frac{1}{4}$ |
| and cap | | | | | | | | | | | | | | | |
| 3 | $3\frac{1}{4}$ | 3 | 3 | 2 | $2\frac{7}{8}$ | 2 | $2\frac{3}{4}$ | 2 | $2\frac{5}{8}$ | | $2\frac{1}{2}$ | | $2\frac{3}{8}$ | | $2\frac{1}{4}$ |
| 2 | $2\frac{1}{8}$ | 2 | 2 | | $1\frac{7}{8}$ | | $1\frac{3}{4}$ | | $1\frac{5}{8}$ | | $1\frac{1}{2}$ | | $1\frac{3}{8}$ | | $1\frac{1}{4}$ |
| 2 | $3\frac{1}{4}$ | 2 | 3 | | $2\frac{7}{8}$ | | $2\frac{3}{4}$ | | $2\frac{5}{8}$ | | $2\frac{1}{2}$ | | $2\frac{3}{8}$ | | $2\frac{1}{4}$ |
| 2 | $3\frac{1}{4}$ | | 3 | | $2\frac{7}{8}$ | | $2\frac{3}{4}$ | | $2\frac{5}{8}$ | | $2\frac{1}{2}$ | | $2\frac{3}{8}$ | | $2\frac{1}{4}$ |
| | $2\frac{1}{8}$ | | 2 | | $1\frac{7}{8}$ | | $1\frac{3}{4}$ | | $1\frac{5}{8}$ | | $1\frac{1}{2}$ | | $1\frac{3}{8}$ | | $1\frac{1}{4}$ |
| | $3\frac{1}{4}$ | | 3 | | $2\frac{1}{2}$ | | $2\frac{1}{4}$ | | 2 | | 2 | | 2 | | 2 |
| | $2\frac{1}{4}$ | | $2\frac{1}{8}$ | | $1\frac{7}{8}$ | | $1\frac{5}{8}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ |
| | $1\frac{1}{16}$ | | $1\frac{8}{16}$ | | $1\frac{6}{16}$ | | $1\frac{5}{16}$ | | $1\frac{4}{16}$ | | $1\frac{4}{16}$ | | $1\frac{4}{16}$ | | $1\frac{3}{16}$ |
| 2 | $\frac{7}{8}$ | 2 | $\frac{13}{16}$ | 2 | $\frac{12}{16}$ | | $\frac{12}{16}$ | | $\frac{11}{16}$ | | $\frac{10}{16}$ | | $\frac{9}{16}$ | | $\frac{9}{16}$ |

| Steel Wire. Standing Rigging. | | | |
|---|---|---|---|
| Size. | Breaking Test. | Size. | Breaking Test. |
| Ins. | Tons. | Ins. | Tons |
| $5\frac{1}{2}$ | 58 | $3\frac{1}{8}$ | $17\frac{1}{2}$ |
| $5\frac{1}{4}$ | 53 | 3 | 16 |
| 5 | 48 | $2\frac{7}{8}$ | $14\frac{1}{2}$ |
| $4\frac{7}{8}$ | 44 | $2\frac{3}{4}$ | 13 |
| $4\frac{3}{4}$ | 42 | $2\frac{5}{8}$ | 12 |
| $4\frac{5}{8}$ | 40 | $2\frac{1}{2}$ | 11 |
| $4\frac{1}{2}$ | 38 | $2\frac{3}{8}$ | 10 |
| $4\frac{3}{8}$ | 36 | $2\frac{1}{4}$ | 9 |
| $4\frac{1}{4}$ | 34 | $2\frac{1}{8}$ | 8 |
| $4\frac{1}{8}$ | 32 | 2 | 7 |
| 4 | 30 | $1\frac{7}{8}$ | 6 |
| $3\frac{7}{8}$ | 28 | $1\frac{3}{4}$ | $5\frac{1}{2}$ |
| $3\frac{3}{4}$ | 26 | $1\frac{5}{8}$ | 5 |
| $3\frac{5}{8}$ | 24 | $1\frac{1}{2}$ | 4 |
| $3\frac{1}{2}$ | 22 | $1\frac{3}{8}$ | $3\frac{1}{4}$ |
| $3\frac{3}{8}$ | $20\frac{1}{2}$ | $1\frac{1}{4}$ | 3 |
| $3\frac{1}{4}$ | 19 | | |

5.—The steel wire ropes to be guaranteed to withstand the breaking stress given in the table, and no hemp is to be used in the strands, a hemp core only to be fitted.

6.—A short length of each of the wires composing the rigging will be required, after being galvanized, to withstand a tensile stress equivalent to that set forth in the Table, and the aggregate strength of the wires must not be less than 10 per cent. in excess of that stress.

7.—Each wire will be required to be capable of being twisted around itself not less than eight times and of being untwisted and straightened without breaking.

| Register Tonnage Under Deck. | Tons. 1,800 to 2,000 | | Tons. 1,600 to 1,800 | | Tons. 1,400 to 1,600 | | Tons. 1,200 to 1,400 | | Tons. 1,000 to 1,200 | | Tons. 800 to 1,000 | | Tons. 700 to 800 | | Tons. 600 to 700 | | Tons. 500 to 600 | | Tons. 400 to 500 | | Tons. 300 to 400 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. | Size. Inches. | No. | Size. Inches. | No. | Size. Inches. | No. | Size. Inches. | No. | Size. Inches. | No. | Size. Inches. | No. | Size. Inches. | No. | Size. Inches. | No. | Size. Inches. | No. | Size. Inches. | No. | Size. Inches. |
| Fore & Main Shrouds ... | 6 and cap | $5\frac{1}{2}$ | 6 and cap | $5\frac{1}{4}$ | 6 and cap | 5 | 6 and cap | $4\frac{3}{4}$ | 6 and cap | $4\frac{1}{2}$ | 5 and cap | $4\frac{1}{4}$ | 5 and cap | 4 | 5 and cap | $3\frac{3}{4}$ | 5 | $3\frac{1}{2}$ | 4 | $3\frac{1}{4}$ | 4 | 3 |
| „ „ Chain plates ... | | $2\frac{1}{4}$ | | $2\frac{1}{8}$ | | 2 | | $1\frac{7}{8}$ | | $1\frac{3}{4}$ | | $1\frac{3}{8}$ | | $1\frac{5}{8}$ | | $1\frac{5}{8}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ |
| „ „ Dead-eyes ... | | $12\times7$ | | $11\frac{1}{2}\times6\frac{1}{2}$ | | $11\times6$ | | $10\frac{1}{2}\times6$ | | $10\times6$ | | $9\frac{1}{2}\times5\frac{1}{2}$ | | $9\times5\frac{1}{2}$ | | $8\frac{1}{2}\times5$ | | $8\times5$ | | $7\frac{1}{2}\times4\frac{1}{2}$ | | $7\times4\frac{1}{2}$ |
| „ „ Lanyards (hemp) | | 6 | | $5\frac{3}{4}$ | | $5\frac{1}{2}$ | | $5\frac{1}{4}$ | | 5 | | $4\frac{3}{4}$ | | $4\frac{1}{2}$ | | $4\frac{1}{4}$ | | 4 | | $3\frac{3}{4}$ | | $3\frac{1}{2}$ |
| „ „ Topmst. bckstys. | 3 | $5\frac{1}{2}$ | 3 | $5\frac{1}{4}$ | 3 | 5 | 3 | $4\frac{3}{4}$ | 3 | $4\frac{1}{2}$ | 2 | $4\frac{1}{4}$ | 2 | 4 | 2 | $3\frac{3}{4}$ | 2 | $3\frac{1}{2}$ | 2 | $3\frac{1}{4}$ | 2 | 3 |
| „ „ Top-gllt. bckstys. | 2 | 4 | 2 | $3\frac{3}{4}$ | 2 | $3\frac{1}{2}$ | 2 | $3\frac{1}{4}$ | 2 | $3\frac{1}{8}$ | 2 | 3 | | $2\frac{3}{4}$ | | $2\frac{5}{8}$ | | $2\frac{1}{2}$ | | $2\frac{1}{4}$ | | 2 |
| „ „ Lower stays | 2 | $5\frac{1}{2}$ | 2 | $5\frac{1}{4}$ | 2 | 5 | 2 | $4\frac{3}{4}$ | 2 | $4\frac{1}{2}$ | 2 | $4\frac{1}{4}$ | 2 | 4 | 2 | $3\frac{3}{4}$ | 2 | $3\frac{1}{2}$ | 2 | $3\frac{1}{4}$ | 2 | 3 |
| „ „ Topmast stays | 2 | $5\frac{1}{2}$ | 2 | $5\frac{1}{4}$ | 2 | 5 | 2 | $4\frac{3}{4}$ | 2 | $4\frac{1}{2}$ | 2 | $4\frac{1}{4}$ | 2 | 4 | | $3\frac{3}{4}$ | | $3\frac{1}{2}$ | | $3\frac{1}{4}$ | | 3 |
| „ „ Topgallant stays | | 4 | | $3\frac{3}{4}$ | | $3\frac{1}{2}$ | | $3\frac{1}{4}$ | | $3\frac{1}{8}$ | | 3 | | $2\frac{3}{4}$ | | $2\frac{5}{8}$ | | $2\frac{1}{2}$ | | $2\frac{1}{4}$ | | 2 |
| Mizzen Shrouds ... | 5 and cap | $4\frac{1}{2}$ | 5 and cap | $4\frac{1}{4}$ | 5 and cap | 4 | 5 and cap | $3\frac{3}{4}$ | 5 | $3\frac{1}{2}$ | 5 | $3\frac{3}{8}$ | 5 | $3\frac{1}{4}$ | 4 | $3\frac{1}{8}$ | 4 | 3 | 3 | $2\frac{7}{8}$ | 3 | $2\frac{3}{4}$ |
| „ Topmast backstays ... | 3 | $4\frac{1}{2}$ | 3 | $4\frac{1}{4}$ | 3 | 4 | 3 | $3\frac{3}{4}$ | 3 | $3\frac{1}{2}$ | 2 | $3\frac{3}{8}$ | 2 | $3\frac{1}{4}$ | 2 | $3\frac{1}{8}$ | | 3 | | $2\frac{7}{8}$ | | $2\frac{3}{4}$ |
| „ Topgallant backstays | 2 | $3\frac{1}{4}$ | 2 | 3 | 2 | $2\frac{3}{4}$ | 2 | $2\frac{1}{2}$ | 2 | $2\frac{1}{4}$ | | $2\frac{1}{8}$ | | 2 | | 2 | | $1\frac{3}{4}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ |
| „ Lower stays ... | 2 | $4\frac{1}{2}$ | 2 | $4\frac{1}{4}$ | 2 | 4 | 2 | $3\frac{3}{4}$ | 2 | $3\frac{1}{2}$ | | $3\frac{3}{8}$ | | $3\frac{1}{4}$ | | $3\frac{1}{8}$ | | 3 | | $2\frac{7}{8}$ | | $2\frac{3}{4}$ |
| „ Topmast stays ... | 2 | $4\frac{1}{2}$ | 2 | $4\frac{1}{4}$ | 2 | 4 | 2 | $3\frac{3}{4}$ | | $3\frac{1}{2}$ | | $3\frac{3}{8}$ | | $3\frac{1}{4}$ | | $3\frac{1}{8}$ | | 3 | | $2\frac{7}{8}$ | | $2\frac{3}{4}$ |
| „ Topgallant stays ... | | $3\frac{1}{4}$ | | 3 | | $2\frac{3}{4}$ | | $2\frac{1}{2}$ | | $2\frac{1}{4}$ | | $2\frac{1}{8}$ | | 2 | | 2 | | $1\frac{3}{4}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ |
| Bobstay Bar ... | | $3\frac{3}{4}$ | | $3\frac{5}{8}$ | | $3\frac{1}{2}$ | | $3\frac{1}{4}$ | | 3 | | $2\frac{1}{2}$ | | $2\frac{1}{4}$ | | 2 | | 2 | | 2 | | 2 |
| „ Pin ... | | $2\frac{3}{4}$ | | $2\frac{5}{8}$ | | $2\frac{1}{2}$ | | $2\frac{1}{4}$ | | $2\frac{1}{8}$ | | $1\frac{7}{8}$ | | $1\frac{5}{8}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ | | $1\frac{1}{2}$ |
| „ Chain ... | | $1\frac{1}{16}^{4}$ | | $1\frac{1}{16}^{3}$ | | $1\frac{1}{16}^{2}$ | | $1\frac{1}{16}^{0}$ | | $1\frac{1}{16}^{8}$ | | $1\frac{1}{16}^{6}$ | | $1\frac{1}{16}^{5}$ | | $1\frac{1}{16}^{4}$ | | $1\frac{1}{16}^{4}$ | | $1\frac{1}{16}^{3}$ | | $1\frac{1}{16}^{3}$ |
| Bowsprit Shrouds ... | 2 | 1 | 2 | 1 | 2 | $\frac{7}{8}$ | 2 | $\frac{7}{8}$ | 2 | $\frac{13}{16}$ | 2 | $\frac{12}{16}$ | | $\frac{12}{16}$ | | $\frac{11}{16}$ | | $\frac{10}{16}$ | | $\frac{9}{16}$ | | $\frac{9}{16}$ |

Equivalent strengths of Good Steel Wire.

| | In. | In. | In. | In. | In. | In. | In. | In. | In. | In. | In. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Iron ... | $5\frac{1}{2}$ | $5\frac{1}{4}$ | 5 | $4\frac{3}{4}$ | $4\frac{1}{2}$ | $4\frac{1}{4}$ | 4 | $3\frac{3}{4}$ | $3\frac{1}{2}$ | $3\frac{1}{4}$ | 3 |
| Steel ... | $4\frac{3}{4}$ | $4\frac{1}{2}$ | $4\frac{1}{4}$ | $4\frac{1}{3}$ | 4 | $3\frac{3}{4}$ | $3\frac{1}{2}$ | $3\frac{1}{4}$ | 3 | $2\frac{3}{4}$ | $2\frac{1}{2}$ |

1.—The above sizes are intended to apply to vessels in which the dimensions of the masts and yards are such as would not be deemed unusual for vessels of the respective tonnages.

2.—Where double topgallant yards are to be adopted, a topmast cap backstay should be fitted.

Note.—It will be noticed that this Table specifies "hemp" as the material for lanyards, but the best rope for this purpose is specially made, five-stranded, tarred manila; this does not get long jawed or want worming, and stands far better than "europe." Wire lanyards are sometimes used, but are not so good as manila.

Topmast backstays and lower shrouds are the same size.

Topmasts are first stayed, the backstays are then set up, and the rigging last.

## WORM, PARCEL, SERVE, AND MARL.

Worming is passed into the lay of a rope to give it a snug, round appearance. Small ropes are wormed with rope yarns, or marline; larger ropes are wormed with either spun yarn or amberline. The ends of worming are either seized on the rope, or tucked through the strands, then passed round the rope in each respective lay, and hauled hand tight. A soft strand is then passed round the rope and round a serving mallet *(see Plate No. 88)*, which is worked along the rope, and which heaves the worming taut into the lay of the rope; when the worming is well hove in, the ends are again tucked through the lay of the rope and cut off. If the worming is not to be served over, the ends must be tucked twice through the rope before cutting them off. Very large ropes are sister wormed, which is done by placing on each side of the worming a smaller thread put on by hand.

Parcelling is made by tarring half worn canvas and cutting it in narrow strips; this is wound round the rope above the worming, to prevent water getting into the heart of the rope *(see Plate No. 88.)* When parcelling standing rigging, pass it so that one lay of it overlaps the edge of the other, and be careful to commence at the bottom and parcel upwards. An old sea rhyme says :—

"Worm and parcel with the lay,
Then serve and marl the other way."

Service is employed to keep the rope from getting chafed. When beginning the service, place your left side against the rope, and work from you, taking the turns from right to left round the rope, the opposite way to the hands of a watch, in right-handed rope. Of course if the rope is left-handed this order of things must be exactly reversed, but in any case always remember service must be put on against the lay.

Having taken four turns round the rope, take the end and shove it under these four parts, then heave each of these turns well taut over the end. Ship your serving mallet in its place, and take over it, and round the rope three turns *(see Plate No. 88)* and heave on your service with the mallet as tight as necessary. Standing rigging should be served very tight, but any rope that has to work through a block should only be served moderately tight, or rather slack served. When

about to finish off the ends of service, slack up the last four turns and pass the end through the four bights, then render each turn taut separately, and heave them in with a marlingspike, then pull the end through tight and cut it close off.

Marling hitches are employed in fastening a sail to the footrope *(see Plate No 88)*: also parcelling that has not to be served over is kept in its place by marling it tight upon the rope with hitches.

When about to marl parcelling on a rope, first secure the end of the marline round both parcelling and rope with a timber hitch; then place your left side against the rope, and work towards you. With the left hand throw the bight of the marline over the top and underneath the rope, and as the bight comes up, with the right hand pass the ball or end of your marline through this bight on your near side of the rope: this when rendered taut forms a marling-hitch. To render this hitch tight proceed thus:—With the left hand haul the bight of the marline on the near side of the rope upwards *against the lay* of the parcelling, being careful in doing so that you do not pucker it, and with the right hand render tight the hitch, and proceed in the same way with each successive hitch. In fact the manipulation is much easier done in actual practice than to describe it in writing, as it is accomplished very quickly. Mooring hawsers, coming in the wake of iron rings, posts on shore, or iron bollards on board, should all be roughly marled and parcelled, to prevent them getting chafed or injured.

## WIRE SPLICING.

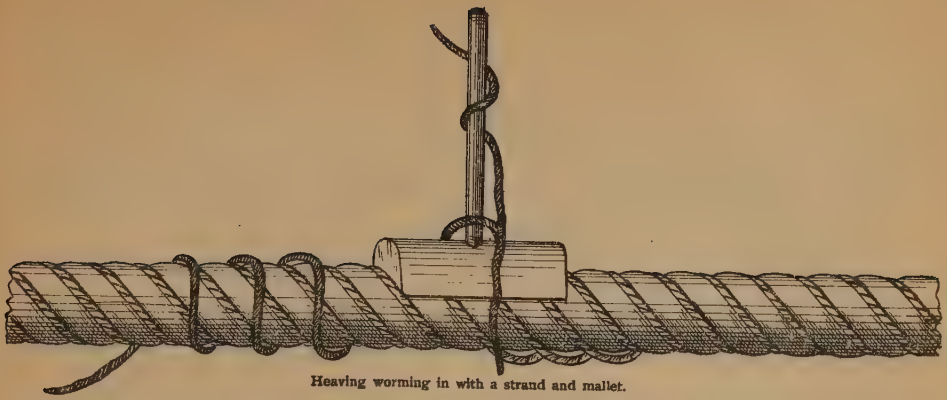
Wire splicing at the present day is a distinct branch of the rigging trade itself, so much so that in all large roperies two or three men are kept constantly employed doing nothing else. So as wire is the order of the day both for steamers and ships' standing rigging, besides being used for all kinds of transporting ropes and mooring hawsers, it is very essential that seamen should know how to handle and splice wire in a proper manner, so we will try and describe the usual methods employed by practical wire splicers.

Mostly all wire ropes are six-stranded, and are layed up as right-handed or left-handed ropes, right-handed being the most in favour with the riggers at the present time.

Through the centre of the rope runs a europe heart, and this heart is the same size as a strand of the rope. (Bear this in mind.)

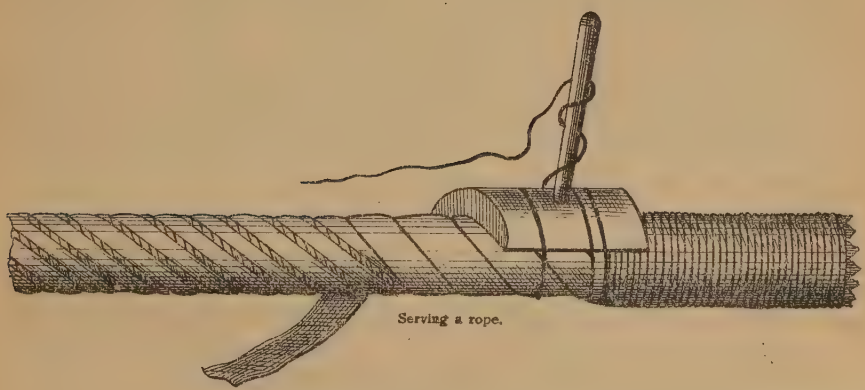
Each strand has also a europe heart in it, the heart being the same size as the wires composing the strand.

The long splice being the most important, we will describe it first.

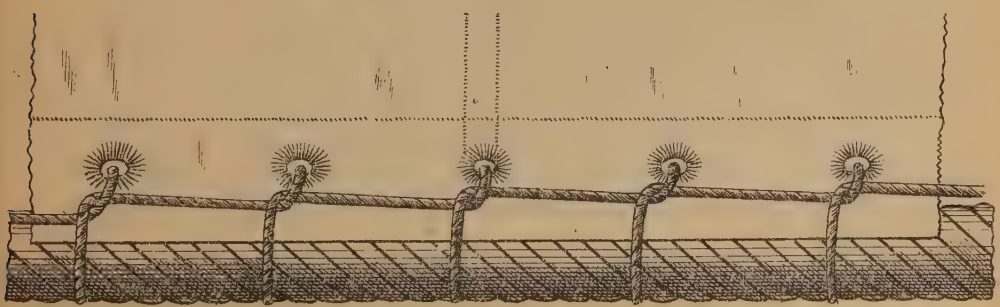


Heaving worming in with a strand and mallet.

Parcelling a rope.



Serving a rope.



Marling on the footrope of a sail.

Unlay the strands to be spliced several feet; if a good-sized rope, you will require nine feet of each end of it to make a good splice. Mind place a good seizing round the rope before you start to unlay it. When unlaying it, unlay two strands together, this keeps the rope in its original lay (mind if you unlay the strands singly it is impossible to form a neat splice). Then put the ends of the rope together in the same manner as a three-stranded hemp rope, and lay it up so that the strands are equal distances apart, the same as in an ordinary long splice—(*see Plate No. 89*)—then take two of the ends, which are double strands, and unlay them singly; then lay them up a short distance clear of each other ready for splicing, and serve all the rest of the strands in the same way, so that the splice will appear as represented in the plate.

Now fix upon two ends to begin the splice, and where the two strands come together, shove a marlingspike right through the centre of the rope above and below three strands; this spike must be kept through the rope till the strand you are working with is finished; then, with another marlingspike, pick out the europe heart of the rope in the wake of the marlingspike and cut the bight—(*see Plate No. 89*)—then work the heart out of the rope a few inches, and at the same time force the strand you are working with into the place the europe heart formerly occupied; this is easily done by turning the marlingspike round that you first placed through the centre of the rope. As you turn it round (it will require considerable force to do so), it will work its own way along the rope, and by a little manipulation the strand you are working with will go right into the heart of the rope; work it along in the heart of the rope a few inches till it joins the europe heart, then cut the ends close off so that the europe heart and the wire strand lie in the centre of the rope, with their ends touching each other. Being a six-stranded rope the splice cannot draw. Serve all the other strands in the same way, and when the splice is finished, and the ends of the wires neatly cut off, you will not be able to see where the rope is spliced.

If it is a transporting hawser, when finishing off the end of the strand you may, if you like, tuck it once round a strand; but if it happens to be a piece of rigging you are splicing, this is quite unnecessary. The novice at wire splicing may think because the ends of the strands are not tucked, the splice will draw. We can assure him such is not the case. Remember the rope is *six stranded*—a splice made as described will never draw; the rope will break first. And as you have merely taken out of the rope a europe heart, and in its place put in a

wire heart, the rope, when spliced, will be the same size throughout, and a very neat job it is when finished.

Ropers and riggers use a long tapered steel marlingspike for splicing wire, with a small *flat* point. This flat point is of great service in picking up the strands in a large close layed rope.

We will now try and describe the eye-splice. There are several methods in vogue in tucking the strands, and each roper and rigger you meet considers his way is the proper way to do it. It is, however, quite unnecessary to go into the different methods, as we will give the necessary directions how to make a good, neat, and strong eye-splice, suitable for either splicing in a lower rigging dead-eye, a long eye for a towline, or in fact any other eye-splice that is called for on board of a ship.

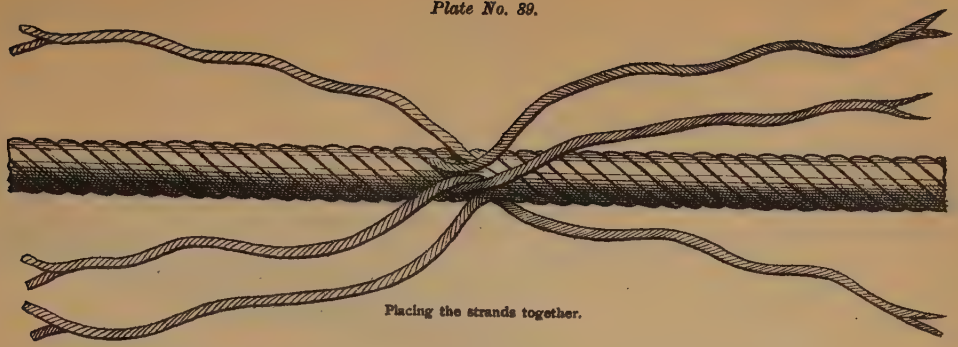
As there are six strands to tuck, we have thought it best to number the strands in the illustrations, so that the novice will at once see how to unlay the strands preparatory to making the splice, and place them in their proper position by referring to *Fig. 1, Plate 89*

When splicing wire never withdraw your marlingspike till after you have tucked the strand, and hauled the slack of it through. When pointing the strand pass it close alongside of the marlingspike, either above it or below it will do; and mind before you point a strand take a couple of turns out of it, so that it will lie flat and snug on the rope.

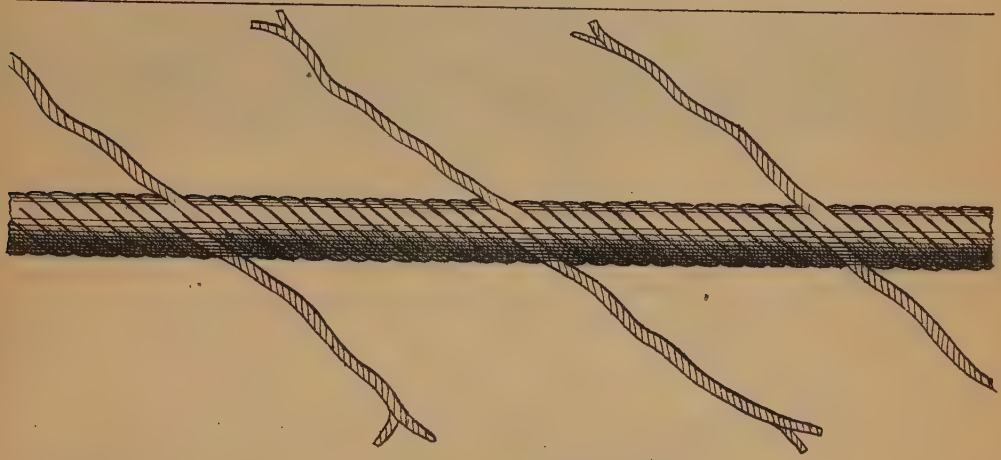
Before unlaying the strands to make an eye-splice, place a tight seizing round the rope, about eighteen inches or two feet from its end, according to the size of the rope. Do not pinch yourself in the length of strand if you can avoid it; when the seizing is taut on, unlay the strands singly up to the seizing.

Then take a piece of amberline, and hang the bight of the wire rope to something, so that the splice itself will be as high as your chin; and see in making the bight fast with the amberline that the rope will not turn in the seizing, and that there is about two feet drift between the part of the rope you intend to tuck the strands and the amberline seizing: by this means you can heave a turn or two out of the rope at pleasure, which enables you to work in the strands as required. Always work your marlingspike with its point from you, then if it slips on the wire no damage is done; and remember the manipulation of the whole splice greatly depends on hanging it up and seizing it carefully as directed.

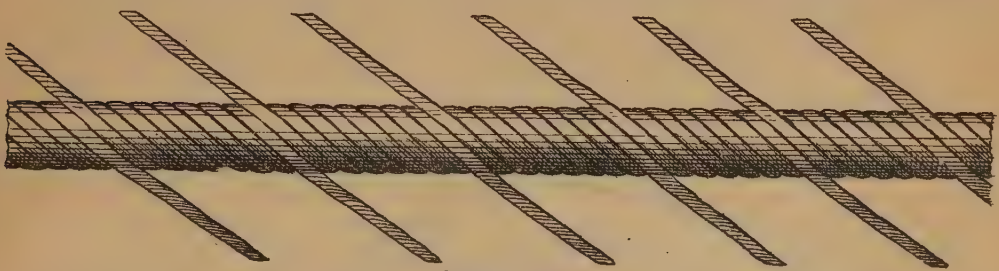
If you try to splice it lying on the deck, or on your knees, failure is sure to be the result as regards a neat splice, therefore it is very important to pay great attention to the hanging up of the rope, as it materially adds to the success of the undertaking.



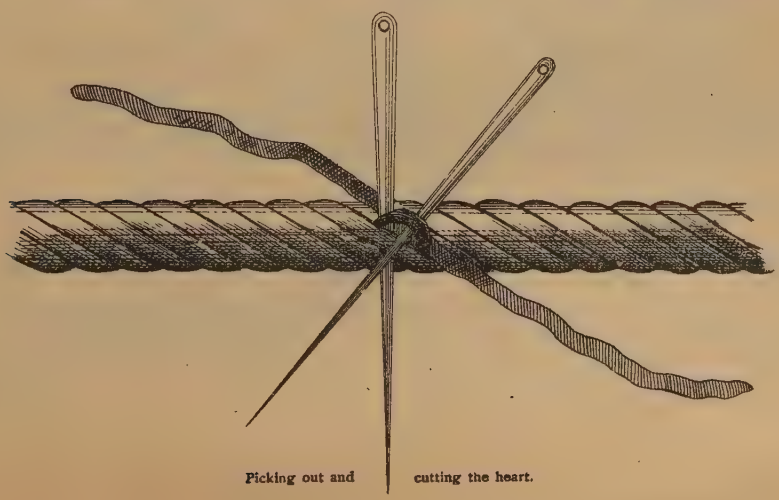
Placing the strands together.



Laying up the rope before singling the strands.



Ready for splicing.



Picking out and cutting the heart.

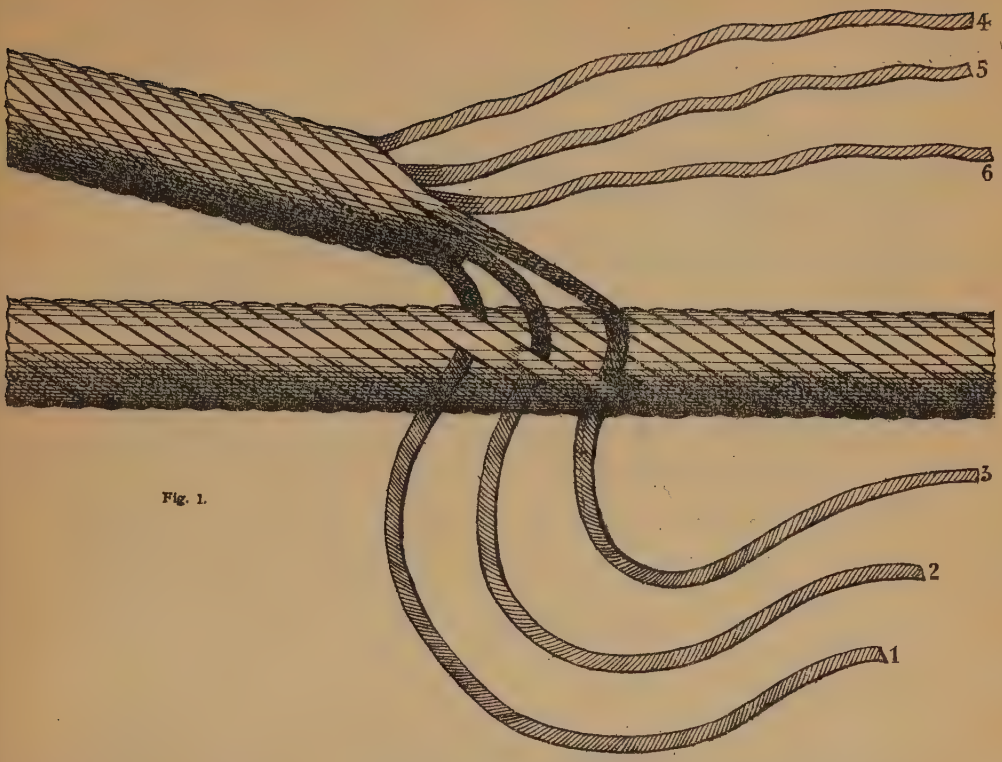
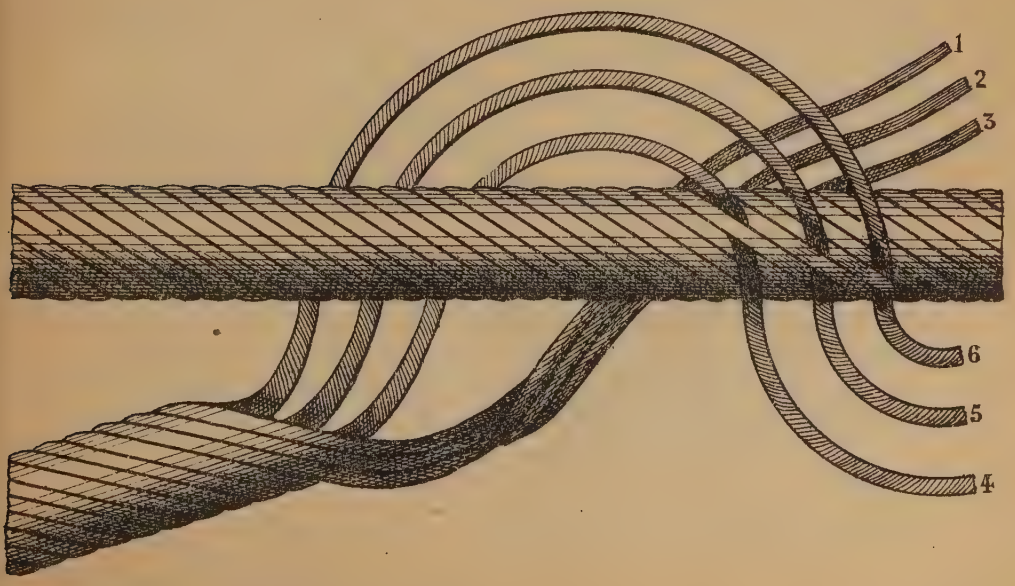



Fig. 1.

Fig. 2.



When bending the rope round to form the splice, place the unlaid end on the left side of the standing rope. *(See Plate No. 89a).*

Unlay the strands so that three lie towards your right, and three towards your left hand. The three that lie to the right must be the upper set. Firstly, take No. 1 strand and tuck it down through two strands, then No. 2 strand enters the same lay of the rope as No. 1, but only passes under one strand, and the last of the set, No. 3, is tucked through the next strand above No. 2.

Now turn the splice half round, and it will appear as represented in *Plate No. 89a;* then take No. 4 and tuck it round the strand next to No. 3, next follow Nos. 5 and 6, each following one another round their respective strands.

The splice has now resolved itself into this:—The first strand was tucked under two strands, and all the rest following it tucked under one strand respectively. By tucking the strands in this manner each strand comes out in its proper lay; and remember the tucked strands are all worked round the strand of the standing rope from beginning to end, in the same manner as a sailmaker's splice, which means tucking all strands from left to right.

When all strands are tucked once through the rope, haul them all moderately tight, and beat each strand into its proper place; the tools required for accomplishing this object successfully being a long tapered marlingspike, flat pointed, a hammer, and a strong hand-vice, fitted with two pieces of hollowed steel to fit the rope.

Do not haul the parts of the rope that have not been unlayed, close together at the neck of the splice; if you do, depend upon it a lumpy splice will be the result.

Always leave an inch space in the neck of the splice: more if it is a very large rope. This gives the strands a chance to lay to their work, and bear an equal strain when a great weight is hove upon the rope.

Having tucked the strands once, and got them into their proper places, then tuck them again *whole* twice. (Mind it is only in the first tucking that strand No. 1 is passed under two strands; in each succeeding tucking it only passes under one strand, and is spliced along the rope in the same manner as the other five strands.) Now you have tucked the strands, in all, whole three times through the rope; so, to finish off the splice, halve the strands and tuck them once. When tucking the strands do not nip them short round, but endeavour to get the wires of the tucked strands to lie in the same way as the wires in the standing part of the rope.

To make a neat eye-splice in a heavy rope requires a good deal of hammer and marlingspike manipulation after the splice is formed; and can only be come at to perfection by constant practice. All eye-splices should be neatly parcelled with oily canvas, and served over with good amberline, spun yarn being quite inadequate for the purpose.

This description, and its accompanying plates, are for a six-stranded, right-handed layed rope, this being the kind at the present time that finds most favour with riggers. But if it so happens you have a left-handed rope to splice, the above directions must be exactly reversed.

This completes the art of wire splicing, and although it only consists of making two splices, viz.:—the eye and long splice—it cannot be learned in a day, and no amount of writing can convey to the novice the art so well as a trip to a wire rigging loft for half an hour; and then, after having taken good stock of all he saw there, coming on board and practising on a piece of wire himself. And if he does not succeed in his first attempt to make a neat splice, let him not feel crest-fallen, but persevere again and again; and later on, at some other time, and at some other place, he will undoubtedly gain the summit of his ambition. Remember Rome was not built in a day. Depend upon it the seamen of the coming day will have to be efficient wire splicers, and will have to handle wire as well as they can rope; and he who is the most adept wire splicer in a vessel is sure to enjoy the respect of his officers, and be the envy and admiration of all his brother shipmates.

Never forget when about to purchase new wire rope to repair old, if the two have to be neatly spliced together, that the new has *exactly* the same amount of lay in it as the old. Mind, although the circumference of the old and new may coincide, the lay may either be longer or shorter; if such is the case it is quite impossible to tail the two together properly. Therefore, when you take the circumference of the old rope, measure carefully the length of its lay. Proceed thus:—Make a mark on one strand of the rope, count seven lays from this mark, and mark it again; the distance between the marks measured on a foot rule gives the length of lay. And as I said above, if the new is not exactly the same lay as the old, discard it at once—it is of no use for the purpose required. And once a roper has cut wire rope to the ordered length and size you cannot return it; so it is very important, when ordering new rope, that the lay should be quoted as well as the circumference, or else you will have a lot of useless rope thrown on your hands that may be unsuitable for any other purpose, and entail extra expense upon the ship.

# STRENGTH OF ROPES.

| Hemp. | Iron. | Steel. | Working Load Cwts. | Breaking Strain Tons. | Ordinary Chain. |
|---|---|---|---|---|---|
| $2\frac{3}{4}$ | 1 | | 6 | 2 | $\frac{5}{16}$ |
| | $1\frac{1}{2}$ | 1 | 9 | 3 | |
| $3\frac{1}{4}$ | $1\frac{5}{8}$ | | 12 | 4 | |
| | $1\frac{3}{4}$ | $1\frac{1}{2}$ | 15 | 5 | |
| $4\frac{1}{2}$ | $1\frac{7}{8}$ | | 18 | 6 | |
| | 2 | $1\frac{5}{8}$ | 21 | 7 | |
| $5\frac{1}{2}$ | $2\frac{1}{8}$ | $1\frac{3}{4}$ | 24 | 8 | $\frac{9}{16}$ |
| | $2\frac{1}{4}$ | | 27 | 9 | |
| 6 | $2\frac{3}{8}$ | $1\frac{7}{8}$ | 30 | 10 | |
| $6\frac{1}{2}$ | $2\frac{5}{8}$ | 2 | 36 | 12 | |
| | $2\frac{3}{4}$ | $2\frac{1}{8}$ | 39 | 13 | |
| 7 | $2\frac{7}{8}$ | $2\frac{1}{4}$ | 42 | 14 | $\frac{11}{16}$ |
| $7\frac{1}{2}$ | $3\frac{1}{8}$ | $2\frac{3}{8}$ | 48 | 16 | |
| 8 | $3\frac{3}{8}$ | $2\frac{1}{4}$ | 54 | 18 | |
| | $3\frac{1}{2}$ | $2\frac{5}{8}$ | 60 | 20 | |
| $8\frac{1}{2}$ | $3\frac{5}{8}$ | $2\frac{1}{4}$ | 66 | 22 | |
| $9\frac{1}{2}$ | $3\frac{7}{8}$ | $3\frac{1}{4}$ | 78 | 26 | $\frac{15}{16}$ |
| 10 | 4 | | 84 | 28 | 1″ |
| | $4\frac{1}{2}$ | $3\frac{3}{8}$ | 90 | 30 | |
| 11 | $4\frac{3}{8}$ | | 96 | 32 | |
| | $4\frac{1}{2}$ | $3\frac{1}{2}$ | 108 | 36 | |
| 12 | $4\frac{5}{8}$ | $3\frac{3}{4}$ | 120 | 40 | |

**Strength of short, round-linked chain such as is used for cranes or rigging.**

| Inches. | Mean breaking Strain Tons. | Test. |
|---|---|---|
| $1\frac{1}{4}$ | 44 | 18·8 |
| 1 | 29 | 12·0 |
| $\frac{7}{8}$ | 23 | 9·1 |
| $\frac{3}{4}$ | 17 | 6·8 |
| $\frac{5}{8}$ | 12 | 4·6 |
| $\frac{1}{2}$ | $7\frac{1}{2}$ | 3·0 |

## SECTION XXVII.

# SAILMAKING.

The art of sailmaking cannot be learnt from books. It is a trade of itself, to which an apprenticeship has to be served. But, at the same time, the young seaman should know something of the art, and use every opportunity at sea of making himself familiar with it. To this end a few general hints will here be given for his guidance.

The canvas in ordinary use of which sails are made is two feet wide. There are eight different qualities of this usually met with, which go by numbers 1 to 8, No. 1 being the heaviest and strongest. The bolts (or rolled up lengths) of canvas are about 40 yards long, and a forty yard bolt of No. 1 ought to weigh 46 lbs. Each following number should weigh 3 lbs. lighter. Besides this weight there is the quality to be considered, and this can only be come at by practice. First class canvas ought to be made of all long flax. A rough test is to take a piece and bore a hole through it with a fid; if an inferior make it will appear brittle, and break easily; if good it will be tough, and the hole small.

Twine, the thread with which sails are made, is spun three-fold of flax. There should be from 370 to 420 fathoms to the pound weight, and a pound of twine should in a good workman's hands sew nearly four bolts of canvas. There is another heavier kind called roping twine, used for roping sails. Before use twine is dipped in tar softened with a little oil, and then wrung out.

In making a sail the edges of the cloths of canvas are sewn together with a double seam (for small vessels the breadth of this seam should be one inch and a quarter, and large vessels one inch and a half for topsails and courses, other sails about one inch.) This is done thus: one cloth is turned down the required breadth, say one inch, then the selvage of the other cloth is sewn to the turned edge of the part thus turned down. When this seam is finished it is rubbed smooth with a wooden "rubber." The cloths are then turned over, and the other selvage edge is sewn in the same way, and again flattened down with the rubber. The young seaman will find in practice that this second seam is sometimes "stuck" or sewn flat; but it must be remembered that sewn as described above is the *stronger* way, two round seams being much stronger than a round and a flat one.

There should be, roughly, an average of about 130 stitches to a yard in making a new sail; in repairing less are required.

When the cloths, properly shaped, have been all sewn together, rope is sewn to the outside edges of the sail; but before this is done the edge of the sail itself is turned in and sewn again: this is called the tabling.

The breadths of the tabling are usually about 4 to 6 inches for courses; 3 to 5 inches for topsails; 3 inches for the lighter sails. For fore and aft sails slightly less.

When the tablings are all stuck (for they are sewn flat) the sail is in shape, and now wants the edging of rope round it.

The rope specially made for this purpose is termed bolt-rope. It is made of fine yarns spun from the best hemp, and tarred with the best Stockholm tar. It is very soft and easy to handle, being not twisted up so tight as ordinary rope. The sewing on of a bolt-rope can only be learnt by practice, as a certain amount of slack of canvas has to be taken in all the way along, and this is entirely a matter of judgment; but the novice will understand this much, that if the rope and canvas were both stretched along and sewn together, when the sail was set the rope would stretch more than the canvas, and that in consequence the strain would come on the canvas instead of the rope, and split the sail. The rope, also, must not get a turn in it whilst going on, and this also is a matter for a practised hand, and even practised sailmakers often spoil a well cut sail by roping it badly.

All sails are gored, that is, they are not actual squares; or their edges are not all straight lines.

A mainsail, crossjack, and all topsails and upper squaresails, are gored in the leaches, and gored or *roached* on the foot.

A foresail, however, is only gored on the foot, the leaches being square.

A jib is not straight sided, being curved or gored on stay, or luff, and foot.

The principal aim of the sailmaking art is, or should be, to get all sails, when they stretch to the strain when set, to set *flat*, and not to belly out; and in fore and aft sails this is very important.

There are many other fittings to a sail, as lining cloths, grommets, cringles, etc., which are given in the sketches.

It is seldom necessary to make a new sail at sea, but often necessary to repair, and in cases to alter them. In repairing, mind not to put in too strong canvas. If in repairing a well-worn royal you were to use new No. 1 canvas, it would split in the first breeze, the new being too strong for the old.

It is never absolutely necessary to make a sail larger, but it is sometimes necessary to make them smaller; you may have a topsail

that has stretched so much that the yard hoisted chock up will not set it, or you may have a trysail too big for the gaff. In such a case the topsail should be handled as follows:—Rip up the head tabling, draw the splices at the head cringles, cut the sail across just below the row of eyelet holes in the head of the sail, cut out what canvas you think necessary, say a foot, then single butt the two edges together again, sew down the tabling, re-splice the leach ropes, and your job is done. If you had started to unrip the head rope and take the canvas off the head of the sail, you would have had all the head rope to run on again, and, worse still, a whole new row of eyelet holes to work afresh.

In the same way with a trysail, do not disturb the after cloth, but take out the next one to it.

The usual practice is to make the foresail and foretopmast staysail of No. 1 canvas; mainsail and lower topsails of No. 2; upper topsails and inner jib of No. 3; topgallantsails and outer jib of No. 4; royals of No. 6; steamers' trysails and fore staysail of No. 2.

A sail is always repaired with canvas of a higher number (or lighter) than that it was made of.

Splices in bolt-ropes are always laid left-handed, and if well made scarcely shew at all.

A young officer may be so situated by the force of circumstances that he is compelled to cut out a suit of sails, so we will endeavour to place him in a position to do so, if not scientifically, at least so as to satisfy the demands of the vessel in which he may be serving at the time.

## THE MAINSAIL.

Say you are about to cut out a mainsail for a vessel of about 1,500 tons burden; then take the following measurements to construct the draft.

| | Feet. | Ins. |
|---|---|---|
| Length of the head—say ... ... | 60 | 3 |
| Length of the foot ... ... ... | 68 | 0 |
| Drop amidships ... ... ... | 30 | 0 |
| Length of leach ... ... ... | 35 | 0 |
| On deck from chess tree to 2 feet before mainmast, allowing 18 inches for drift of tack ... ... ... | 34 | 0 |

These are all the measurements required.

On a large sheet of paper (the back of an old chart answers admirably for this purpose), draft out the mainsails finished size, on a scale of ½ inch to the foot; by making the draft on a smaller scale

you are apt to get mixed with too many lines on it when marking on it the inches of each gore and roach. Therefore we recommend the above scale to the young officer as a good workable draft.

Of course when drafting out any square sail it is only necessary to draw the half of it.

Now run a base line along the lower edge of your paper: this line represents the deck of the vessel. Close to the right hand corner of your paper let fall a perpendicular line upon the base, and assume this line to be the midship seam of the mainsail. Now strike a horizontal line parallel with the base line, near the top of the paper (to scale), at the correct height of the main-yard; and with a pair of compasses dot off on this line each seam or cloth of the mainsail, according to the breadth of the canvas, making due allowance for the overlap of the seams.

Then take a pair of parallel rulers, and rule a perpendicular line through each dot you previously made on the main-yard line, down to the base line. *(See Plate No. 90.)* Now form the roach of the foot according to measurement, and the gore of the leach, and wherever a perpendicular line cuts the leach, draw a horizontal line from the cut into the first seam inside of it; the measurement of this seam from the horizontal line to its apex where it cuts the leach, is the gore of the cloth required. *(See Plate No. 90.)*

Act precisely in the same manner in arriving at the roach in the foot of the sail; and mind be careful you mark the roach gores with an R. and the leach gores with a G., so that no mistake will occur in running the cloths together.

After your draft is properly measured, and plainly marked, then prepare to cut out the sail.

In cutting out, go to work with the midship cloth first. This mainsail has sixteen square cloths in it, meaning cloths that have a square cut on both head and foot, eight of such being on each side of the midship seam. Also remember, when cutting out any square sail, there have to be two cloths cut exactly alike right through the sail, and respectively marked P. for port side, and S. for starboard.

We will now assume you have cut sixteen square cloths, 30 feet each in length, as per draft, and are now going to cut No. 1, which is the first cloth that has any roach in its foot. After you have cut out this cloth, place the cut edge (the bevelled edge) alongside of the corresponding edge of the bolt of canvas you are using, and run off another cloth exactly the same shape and size, and rip it off; mark these cloths as quoted above, P. No. 1, and S. No. 1. And go on thus

till you cut all the cloths out, finishing off by cutting out the leach gores last.

When the sail is sewn together, you can then cut out reef bands, head and foot linings, and the buntline and leachline chafing cloths, &c. No description of cutting these is necessary, as seamen differ considerably in their ideas about the different breadths of the linings and tablings of a sail.

Mainsails generally have a lining cloth sewn on their foot, on the fore part of the sail extending from clew to clew, about one foot in width, to strengthen the foot of the sail; the tabling of the foot being merely basted underneath the lining cloth; also a half cloth is run on both leaches from clew to head. The clews are lined a cloth in width about two or three feet up the leach, according to taste; also a small piece of head lining is sewn on from the head cringle, eighteen inches down the leach, into the first seam. The reef band, in which are sewn the reef points, should be cut six inches in width, and run on the sail (flat-stitched) turned over and tabled down. To help to support the leach rope in the wake of the reef tackle cringle, a half cloth is sewn into the sail, extending from the reef tackle cringle in an angular downward direction—*(See Plate No. 96)*—for several feet

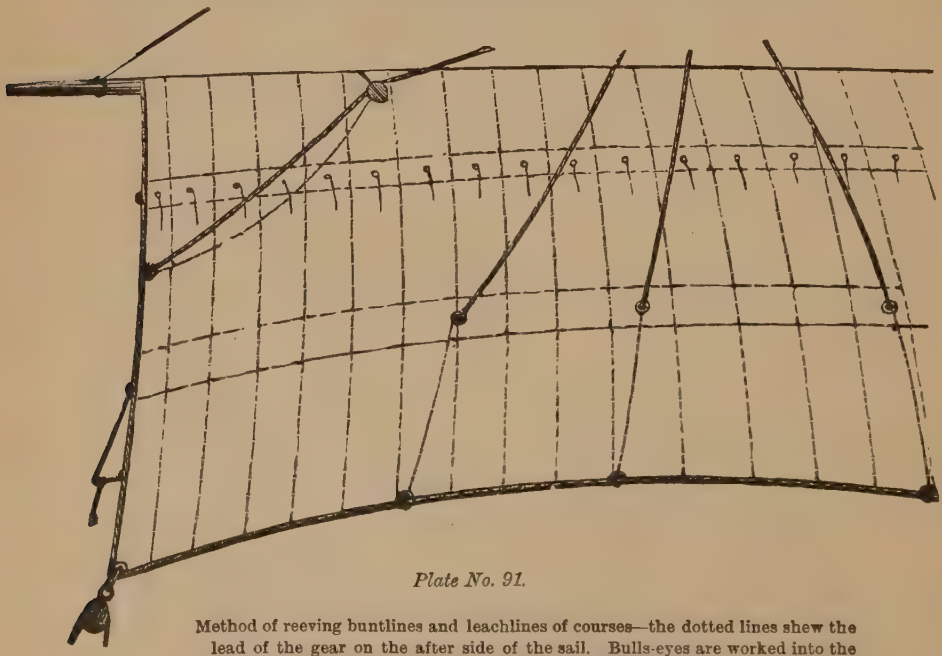


*Plate No. 91.*

Method of reeving buntlines and leachlines of courses—the dotted lines shew the lead of the gear on the after side of the sail. Bulls-eyes are worked into the buntline cloth and in the leach (for the leachline) and the gear rove as shewn.

After all cloths are sewn together and double seamed, place on the lining cloths and reef bands, and table round the edges of the sail; then work in all the eyelets for head rovings, reef points, buntlines, leachlines, and cringles, and when these are finished and fidded moderately out to their proper size the mainsail is ready for roping.

Roping a sail *properly* is the most difficult task to accomplish successfully that a seaman can well have to do on board of a ship, and few attain proficiency in this respect; and, further, it is quite impossible, by written instructions, to convey to a seaman the action requisite to properly rope a sail, for it must be remembered this can only be acquired by long and continued practice.

Before commencing to rope the sail, take a good many turns out of the bolt rope, and stretch it moderately, then splice the end of your bolt rope into the eye of a spectacle, and commence to rope upwards from the port clew of the sail. When the leach is roped up within a foot of the head of the sail, splice in the head eye, and with a connecting splice join the head rope to this eye splice, then rope round the splice and along the head of the sail to the head of the starboard leach; then form another eye, connect the head rope to it, and rope the sail down the starboard leach to within a couple of feet of the clew, then splice in the end of the leach rope to the starboard spectacle and finish roping over the splice In roping over all splices in a sail, a back stitch is formed in every lay of the rope to make the canvas lie firm against the rope in the wake of the splice. The foot rope is now spliced into the starboard spectacle, and the sail roped right across to the port clew and spliced to the port spectacle. Mind when roping the sail you keep the rope laid evenly on the end of the bench, on top of the sail hook you are using, and shake it out every now and then a few feet in advance of where you are sewing it on the canvas, for if you do not tend the rope very carefully you are apt to get a half turn in the rope, and I can assure the novice in roping a sail, nothing the seaman does about a sail looks worse, or is more easily detected and commented on by all his brother seamen, than if he chances to get a half turn in the sail when roping it. Always bear in mind that roping on a bight is a very difficult job even for a first-class sailmaker to accomplish successfully, and a sailmaker will never rope a sail on the bight if he can avoid it by the extra trouble in drawing a splice; therefore, when about to splice two ropes together which will form a bight to rope over, be careful and rope up to the splice as near as possible, for the longer the bight is the greater probability there is, in roping it, that you will get a half or quarter turn in the rope. When

all the sail is roped round, then stick in all cringles where necessary; and lastly, sew in and whip the reef points, when the sail is finished and ready for bending.

In the days of the old-sailing East Indiamen, the foots of courses and topsails were all marled, that is, the foot rope of the sail was made fast to the canvas by a succession of hitches formed by marline from clew to clew. This method is now done away with, the foots of these sails being roped the same as the leaches, and leathered in the wake of any part that chafes.

When roping the leaches of topsails or courses, allow 1 inch of slack canvas to every foot of the rope; and when roping the foots of these sails, allow 1 inch slack canvas to every 3 feet of the rope; and do not forget to stretch the foot-rope well before you commence to rope it, and take plenty of turns in your roping twine.

When drafting square sails, draw your lines to represent cloths 22 inches apart (to scale) in courses and topsails, but 22½ in lining the draft for topgallant sails and royals: this allows for the overlap of the seams.

The number of 22-inch lengths any course or topsail has in its head is therefore the number of cloths required.

The mainsail under consideration should have 3½-inch bolt-rope for leaches and foot rope, and 2¼ for head rope.

Any further lore about making a mainsail may be got from works published on the subject by sailmakers, but we trust we have by these few remarks placed the young officer in a position to cut out a mainsail; and provided he studies out these simple directions, and has a little *nous* about him, he will find the operation not nearly so difficult as he at one time imagined.

Sailmakers have standard rules for cutting out every part of a sail; but we may remark sailmaking is a complete study in itself, and to be an adept at the profession requires years of both *practice* and study.

NOTE.—Foot and leach ropes of malleable steel wire answer well for courses. The leach ropes should be fitted in two parts, and should have an oval link spliced into them at the reef band; the eyes in the wire should be about 18 in. long, and the thimbles, which take the link, seized in. Wire leach ropes in one piece are apt to kink and break; if they are made as above this will not happen.

## THE INNER JIB.

The measurements requisite in drafting out this sail are:—The angle of the stay, the stave of the jibboom, the height of the luff, and the exact position you require the clew.

The rule to find this position is: when a jib is hoisted up its clew should come 2 feet abaft the fore topmast stays, at about 6 to 7 feet above the top part of the inner end of the jibboom.

On *Plate No. 92* the measurements are found to be—

| | | | |
|---|---|---|---|
| Angle of the stay | ... | 30° from the horizontal. | |
| Stave of the jibboom | ... | 20° | „ |
| | | Feet. | Ins. |
| Height of the luff | ... | 60 | 0 |
| After leach | ... | 43 | 6 |
| Foot | ... | 24 | 0 |

Near the lower edge of the paper you are about to draft the sail on, draw a base line, and from the left hand side of this base line throw off a line to represent the length and stave of the jibboom, from the inner part of the bowsprit to the jib stay; from the tack of the jib throw off another line to represent the angle of the jib stay, and dot it where the head of the sail will come. Now calculate the position of the clew, and from the clew draw two lines, one to the head, and the other to the tack of the jib.

You are now ready to form the round of the luff and foot of the sail, for a jib made in this shape would never stand, on account of the hollow line formed in the jib stay, when rousing the jib sheet aft.

So to counteract this flow of the stay, its maximum point must be found and dotted in on the draft.

Rule to find this important point in drafting out a jib is to draw a line at right angles with the after leach, and extend it from the clew of the sail to the stay; then 4 to 5 feet above this line, on the luff of the jib, is the point required. *(See Plate No. 92.)*

On the above-named line, see how many cloths are contained in the sail between the clew and the luff, and for every cloth allow 3 inches; then set off this distance on the opposite side of the stay to the jib, at the point found by the above rule, and dot it; then with a thin long scale sweep a line from the head of the jib through the dot to the tack: this gives the round of the luff.

Opinions differ considerably in regard to round of luff; some sail-makers allow 3 inches per cloth, others more, and again others less. On the annexed plate 2 inches per cloth are allowed, as the writer has found that amount quite sufficient, with double jibs and wire stays.

In the middle of the foot-line of the jib lay off 6 inches, dot it, and sweep a line from the clew through the dot to the tack; this gives the sail a little round in the foot, and prevents a hollow line forming in the foot-rope when the sail is set taut up.

When cutting this sail out, mind and mark each gore with distinctive letters, and number them. When all the cloths are cut, run it together with a single round seam, then rub it well down, turn it over, and fell down the flat seams.

In cutting the sail out, allow a little on each foot gore for the seams being wider at the foot, for by forcing the gores to come in, and making no allowance for the *seaming in*, you will girt the sail. Cut the first cloth at the tack, and work towards the leach. When cutting the canvas, bring a long gore and a short gore together before you cut, for you will lose a good amount of canvas if the gores are not studied.

This sail should have a four-inch tabling on the leach, three inches on the luff, and two inches on the foot, and lined from the head for two feet, also the same at the tack. The clew should have one complete cloth of lining; this should be carried up the after leach 4 feet, and along the foot about 2½ feet.

The Inner Jib being a sail that is generally carried as long as a double reefed topsail, should be made of No. 3 canvas, and well roped—on the luff with 2½ in., foot 2 in., and the leach 2¼ in. best bolt rope, with a stout piece of 3½ in. run round the clew, and carried up the after leach 5 feet, and along the foot 4 feet.

The roping should be put on slack to let the canvas have the weight of the sail; for if a jib is tight roped, it seldom, if ever, will stand when close hauled as it should.

When working in the head and tack cringles, work in a small cringle 2 or 3 feet from the clew on the footrope of the sail; this is used to make fast the gab line, a very useful appendage in taking in and stowing the jib. Jibs are sometimes made with the cloths running into one another, forming a seam from the clew to the luff 10 or 15 feet above the boom, according to the size of the sail; these are termed diagonal jibs. But this is a job for a sailmaker to carry out, and need not be gone into here.

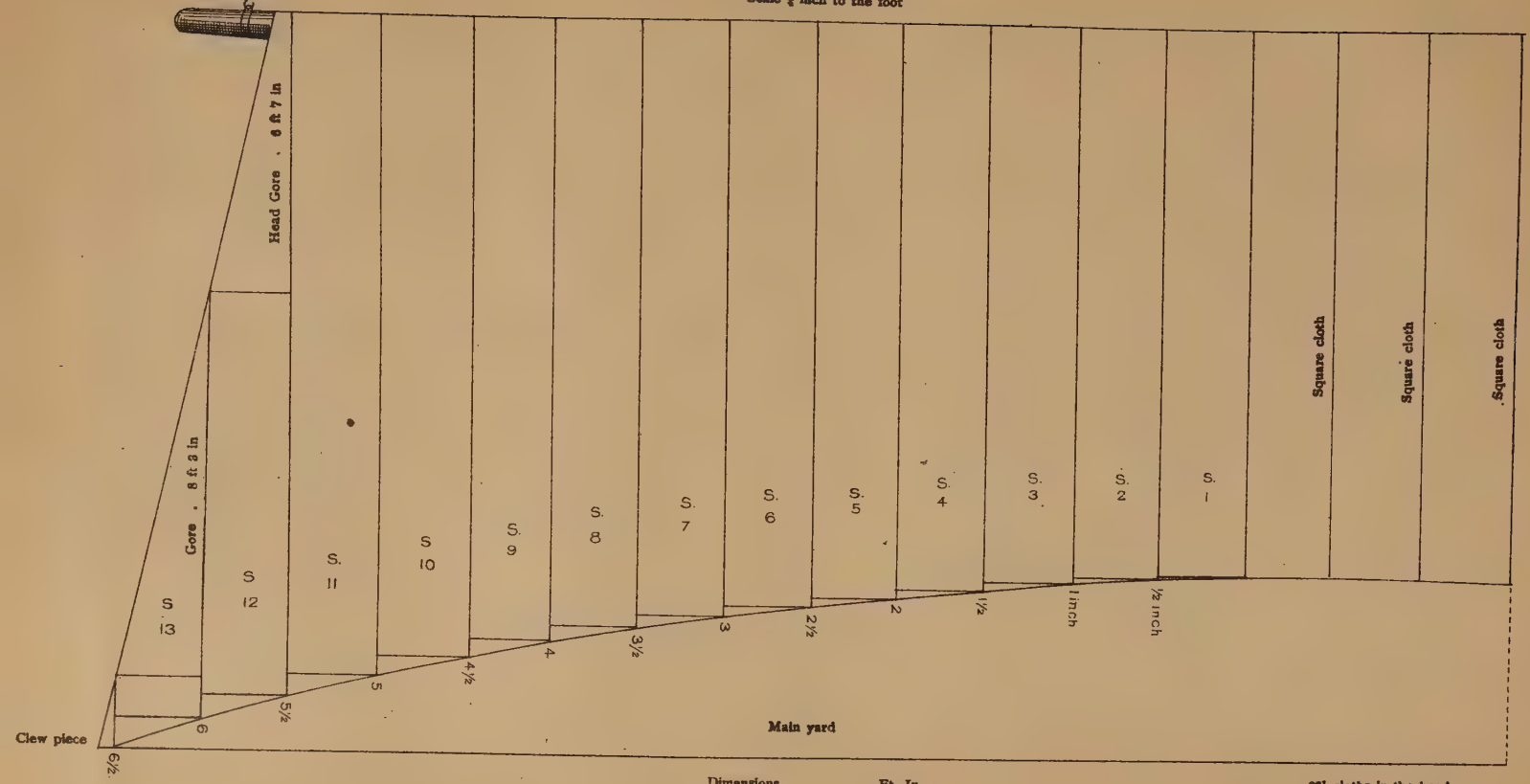
As before remarked in the description of making a mainsail, the roping of the sail cannot be explained in writing, therefore we do not think it necessary to touch upon it, any further than that the writer thinks if an officer can cut out, make and rope an inner jib for a large vessel properly, he is master of the situation in making any other staysail or jib he may try his hand at that is carried on board of a ship, and to such a seaman further instruction in making this description of sail is quite superfluous.

In sewing the seams of the jib, they should be kept wider below the clew, and at the footrope of the sail should be twice their original breadth, tapering off in width at the tack. No allowance in this sail is made for the luff and foot tabling, as it is quite unnecessary.

*Plate No. 93.*

## LOWER MAIN TOPSAIL.

Scale ¾ inch to the foot




| Dimensions. | Ft. | In. |
|---|---|---|
| Head | 53 | 0 |
| Foot | 60 | 0 |
| Leach | 16 | 6 |

28½ cloths in the head
32½ „ „ foot

## To Measure a Trapesium.

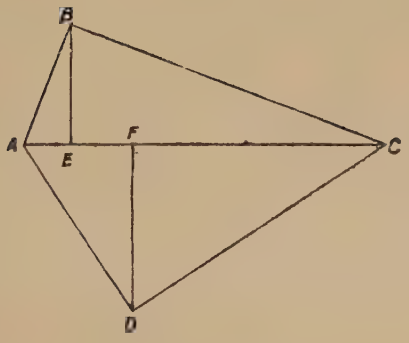
Take perpendiculars from opposite angles of Diagonal.
Multiply sum of perpendiculars by Diagonal.
$\frac{1}{2}$ product = area in sq. ft.

Or

### Yacht Rule.

Diagonal × $\frac{1}{2}$ lower perpendicular.
Add to product L of aft leach × 10.

### Example.




*A C* = Diagonal.
Draw *B E*, *D F* as perpendiculars then proceed as above.

*Plate No. 94*

For the purpose of finding the number of square feet in a fore and aft sail.

## THE LOWER TOPSAIL.

The drafting and cutting out of a topsail is executed in the same manner as in making a mainsail, before described; and taking into consideration what has been already said, we think that by reference to *Plates 90 and 91* the young officer will at once see how to proceed without further instruction, so we will only add a few remarks that we consider absolutely necessary in making this sail.

The topsail under consideration in *Plate No. 93* measures 53 feet in the head, 16 ft. 6 in. in the leach, and 60 ft. for the spread of the clews; but if the sail has to be this size when finished, due allowance must be made for tablings, stretching, and the eating in of the seams.

A good top lining should be sewn on the after part of the sail, to prevent it getting chafed about the top, and this top lining should be 4 to 6 cloths in breadth in the middle of the sail, and carried half up the sail in an angular direction. Each leach should be lined with a full half cloth, from earing to clew, which should be carried round the foot as far as the edge of the top lining.

The sail should also be lined in the wake of each buntline, two-thirds of the depth of the sail from the foot, to prevent the buntlines chafing the sail.

When cutting the sail out, commence at the midship cloths, and cut out each cloth in pairs, plainly marking them S. and P. respectively, and number the cloths accordingly, and finish off by cutting out the leach gores.

In roping the leaches, take in about 3 inches of slack canvas to every yard of the rope; and before roping the foot, put the footrope on a good stretch and take a few turns out of it. When roping the sail, only take in one inch of slack canvas to every yard of the rope, as a footrope of a topsail requires to be much slacker roped than the leaches, so that the bolt rope itself will have more strain than the canvas on the foot of the sail.

A 3½-inch rope is a good size for roping the leaches and foot of a large vessel's lower topsail, and a 2-inch rope for the head.

Spectacles are generally used for the clews, as they are found to be stronger than rope cringles, and are not subject to chafe. These spectacles should be galvanized, to prevent them rusting the sails if stowed away below when not thoroughly dry; the want of them being galvanized properly has ruined many a good topsail.

Head eyelets in square sails are seldom worked in now-a-days with the palm and needle; brass eyelets are made for the purpose, and are both much better for the robands, and quicker put in.

The upper topsail is nearly a square sail, with little or no roach in the foot; therefore no further directions are necessary to the young officer in cutting out this sail.

If an officer can cut out a square mainsail and a lower topsail, topgallant sails and royals are nothing to him, as they are easier made in every way than the lower sails; and if he aspires to a higher altitude in sailmaking than these few simple directions give him, he must study a more pretentious work on the subject.

## A STEAMER'S MAIN TRYSAIL.

*(See Plate No. 95.)*

Drafting and cutting out this sail will give the young officer an idea how to cut out any other fore and aft sail, such as a large vessel's spanker, or fore trysail, as they are all more or less made in the same way.

A base line is first run on the drawing paper to represent the horizontal line of the boom, from the mast to the boom end, according to scale. On the left side of this line throw upwards a line to represent the rake of the mast, and dot it at the height required for the jaws of the gaff. From this dot throw a line to the right hand in an upward direction to the angle of the gaff, and dot it at the required length of the head of the sail; from the latter dot draw a line to the boom end, or to the spot you have determined the clew of the sail to come to, and a line from the clew to the mast at the height above the boom you require the tack of the sail to be, forms the trysail.

The trysail under consideration being a steamer's, the foot is cut straight across; all foot gores like the mast and head gores are, therefore, alike in length respectively; so the sail is an easy one to cut out.

From the line forming the after-leach (on any part of it), throw off a parallel line right across the sail; and at every 22 inches on this line from the after-leach, allowing for the tabling, draw parallel lines from the head to the foot of the sail, and down the mast to the tack; then take a pair of parallel rulers and rule in lines across each cloth, at right angles to the after-leach, at all the intersections of each cloth on both head, foot, and luff of the sail, which will give all the gores, and mark each gore on its own cloth in plain figures in feet and inches. Due allowance must be made in the foot gores for seaming in, as the seams towards the foot should be twice their original width at the clew up to the reef band, and tapered off to their original size near the tack of the sail. The seams, also, should be widened a little at the head of the sail.

The tabling on the head and foot should be 3 inches in width; on the after-leach and the luff 4 inches. A lining cloth should be run on the clew a full cloth in width, extending to the first seam, from the foot 5 feet up the after-leach, and a half cloth lined on the luff of the sail from the head to the tack to bear chafe and strengthen the luff.

The head of the after-leach should also be lined a cloth in width, 3 feet down the leach; these linings ought to be sewn on with a flat seam, and left a little slack, as they are apt to run up when wet, and being lighter canvas than the body of the sail, are not supposed to be able to bear the strain, as the main canvas of the sail will, and would possibly, give way if tabled on too tight. The reef band should be 6 inches broad, and a band is generally run on this sail half a cloth into the fourth seam from the clew, at the angle that the clew strain is the greatest on the sail. Many steamers' trysails have a half cloth run on them from the clew right up to the head of the luff, and it is a plan we can highly recommend, as it prolongs the life of the sail.

When cutting this sail out, commence on the tack, and work towards the after-leach, marking each cloth properly as you cut it, so as to prevent mistakes occurring in getting head gores for foot gores, &c. No time is lost in properly marking each cloth, for the writer cannot impress this matter too strongly on the minds of young officers when first commencing sailmaking.

This sail should have 2½-inch rope on the luff and head, a 2-inch on the foot, and a 2¼-inch on the after-leach, with a stout piece of 3-inch run round the clew and carried up the after-leach 5 feet, and along the foot 4 feet. As a rule, sailmakers rope the luff of steamers' trysails with too small a rope; these sails in many steam vessels being worked by the throat halyards alone, are often set with a powerful steam winch, and the luff rope is therefore subject to heavy strains. The writer has seen, during the last 20 years, more luff ropes of trysails give way than any other sail ropes on board of his vessel, and this has caused him to lose many a good trysail in heavy weather, when they have been hung on to too long.

This sail, like the jib, should be roped slack, or else the sail will bag and stand badly.

## CONCLUDING REMARKS.

Before closing these remarks about sailmaking, we will give the young officer a tip that will be of some service to him, especially if he has had but little experience at such work.

We will assume the vessel is in port, and a young officer has to cut

out and make a jib. Why the jib is named, is that it is one of the most difficult sails to cut out and make properly.

He must try and find on shore a floor, or flagged square, large enough, on which the jib can be stretched; failing these, he must then select a hard piece of level, flat ground. But we will presume he has been lucky, and succeeded in getting the use of a large warehouse floor for a couple of hours. We will also conclude the officer has in his possession the following articles:—a correct draft of the outline of the jib, with the angle of stay, and stave of the boom, a chalk line, a box of tacks, a marking line, a straight edge, and a 50-feet tape line.

He must then draw the jib on the floor to the required size, giving the sail the proper round on both luff and foot. Then commence and cut out the tack piece No. 1, and rub the seam down to the required breadth; lay it on the floor, and tack it at each end in its proper place *temporary*. Then take the canvas and cut No. 2, and rub it down on both selvages to the required breadth of seam. Overlap cloth No. 1 the breadth of the seam, and tack No. 2 down; one tack in each seam will do, and go on thus till the jib is all cut out.

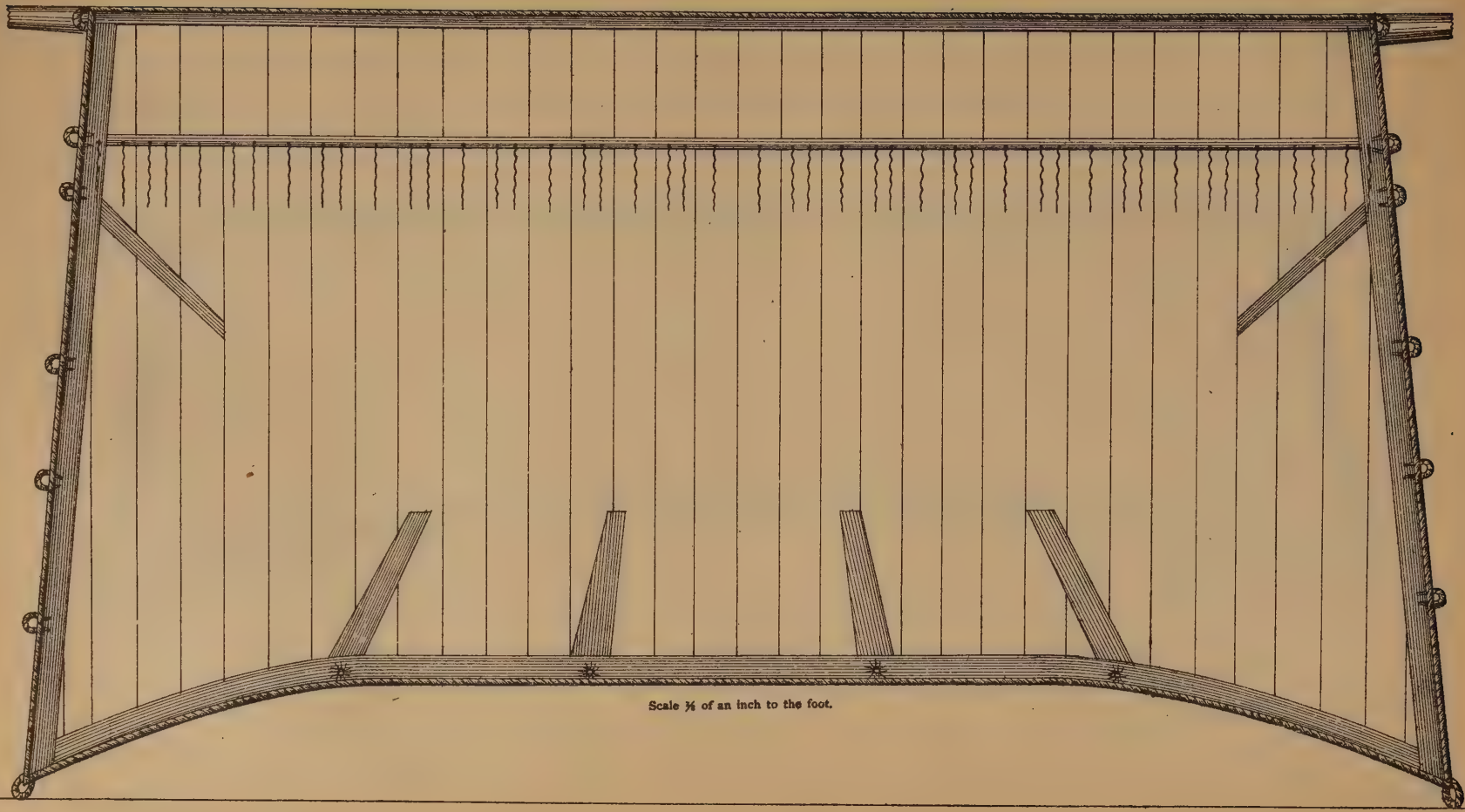
But assuming the officer has not been fortunate enough in finding out a floor of sufficient size to stretch the jib, and that he will be forced to cut it out on a piece of hard level ground.

He must then peg into the earth a chalk line, representing the true outline of the jib by careful measurement, and proceed as before directed, with this exception: that instead of tacking each cloth down as he cuts them, he must employ two men to hold the last cloth down after he has cut it on the line, and under such circumstances he will be compelled to make the best of a bad job.

No seaman need feel the least repugnance in adopting this unscientific method, for rest assured there are hundreds of sails annually cut out in sail lofts in the same way all over the world; and if the powerful factor, *time*, is to be considered in the making of a sail, it may prove to be a quicker method than by making a draft, and cutting out the sail according to the orthodox rules of sailmaking.

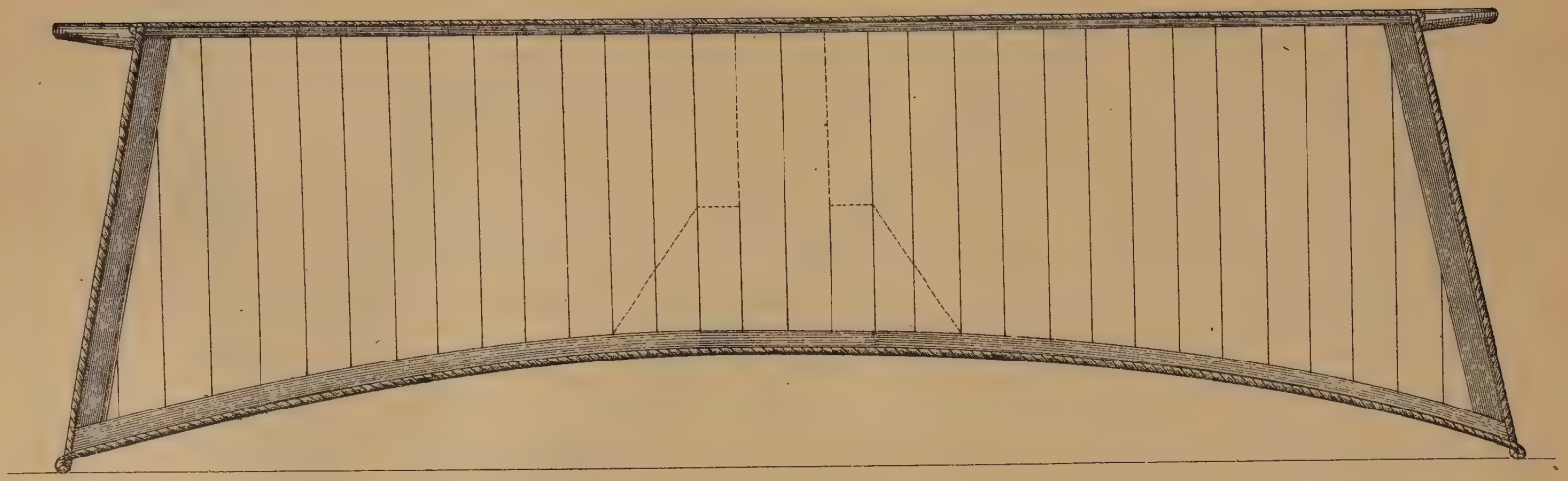
An experienced sailmaker reading over these remarks will no doubt smile, yet he must remember the author is a seaman, not a professor of the art, and that he is merely trying to explain how to make a sail in a rough and ready way to his brother seaman who may chance to be situated at some lonely spot far removed from the beaten track, with all his sails blown away, and others urgently required,—when perhaps the cry has arisen for jolly sailmakers, but alas, this useful body of craftsmen are many thousand miles away.

## A MAINSAIL.



Scale ⅛ of an inch to the foot.

*Plate No. 97.* LOWER TOPSAIL, SHOWING LINING CLOTHS, TABLINGS, AND TOP LINING.



LOWER YARD

Scale ⅛ of an inch to the foot.

*Plate No. 98.*

INNER JIB.

Angle of boom, 20°
Angle of Stay, 30°

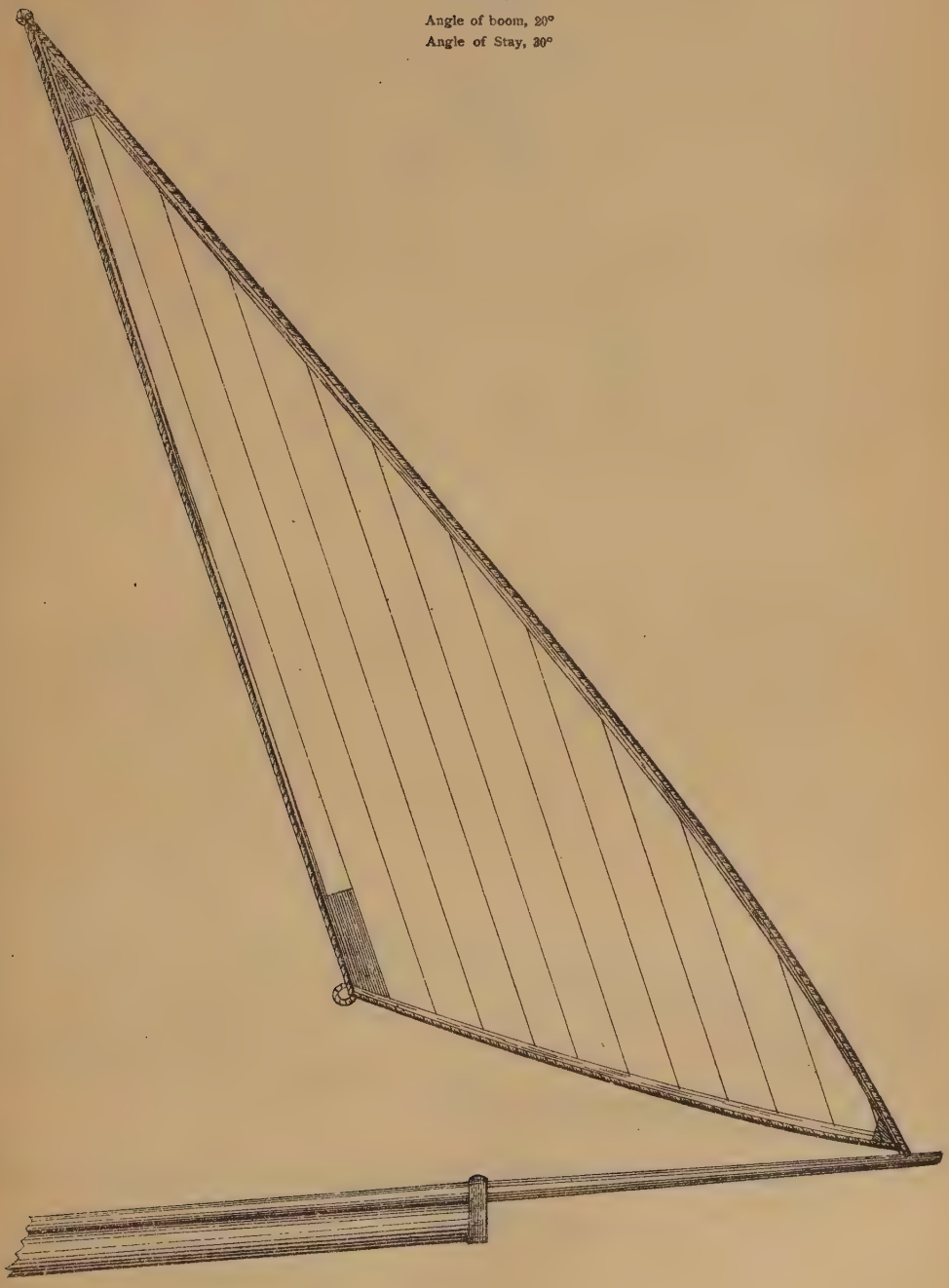


*Plate No. 99.*

## A STEAMER'S MAIN TRYSAIL

Scale ¼ of an inch to the foot.

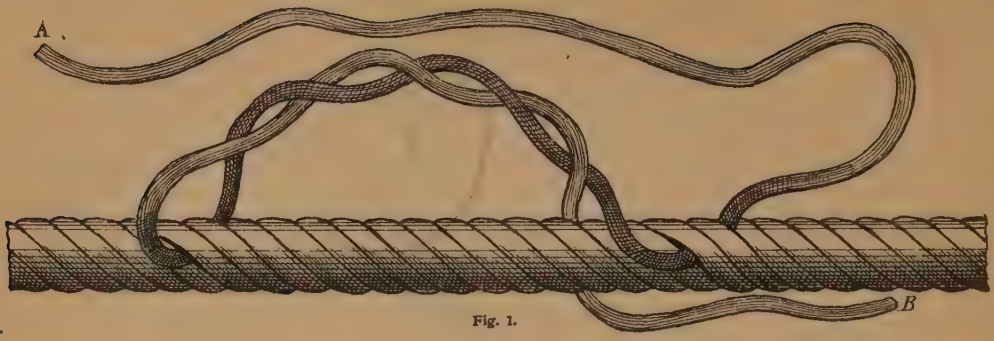



Fig. 1.

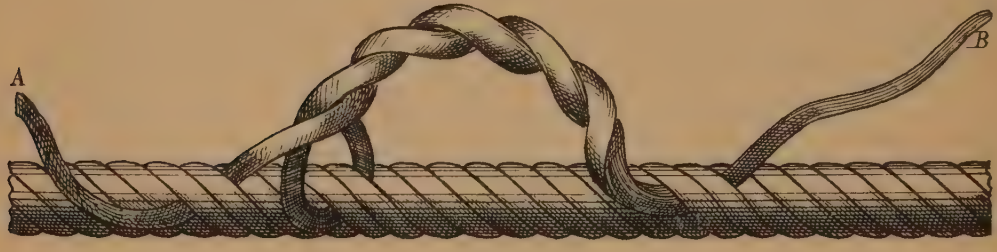



Fig. 2.

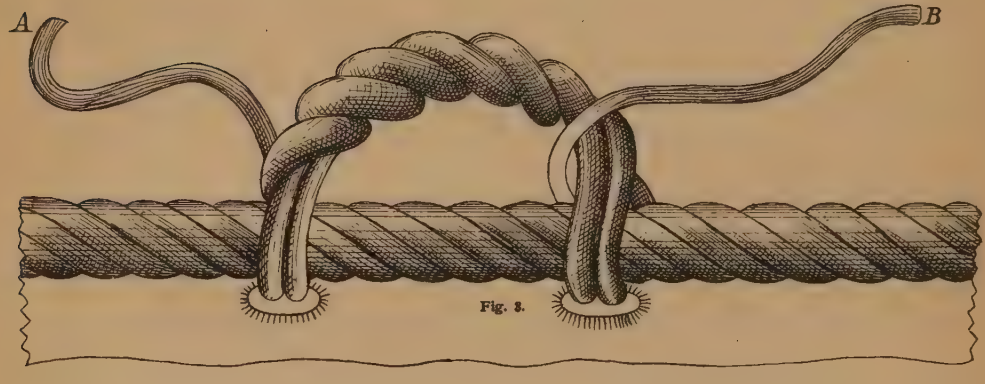



Fig. 3.

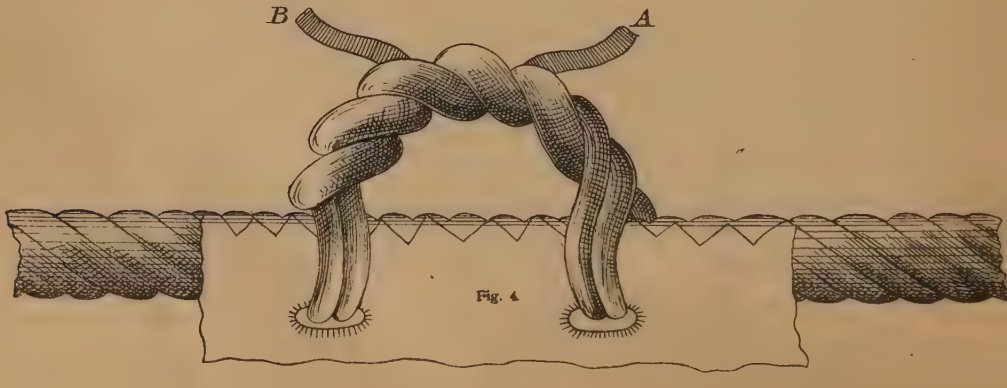



Fig. 4.

Then to a seaman so situated we trust the simple directions herein given will prove, if not scientifically accurate, at least considerably useful to him.

## WORKING CRINGLES.

*See Plate No. 100.)*

*Figures 1 and 2* in the accompanying plate represent working a cringle in a rope. Having selected the part of the rope in which you are about to work the cringle, place your left side towards the rope, then shove a marlingspike under two strands; now divide into three a strand of the required size to form the cringle, and pass its end from you where the marlingspike is through the rope, and haul two-thirds of the strand through. This long end of the strand we will call A, as per sketch, *Fig. 1.* Now lay up the long strand A *three times* round the short strand marked B, ending with the long strand A towards you, and tuck it under two strands of the rope itself outwards or *from you;* bring it now upwards, and lay it back to your left in a lay of the partly formed cringle, and tuck it through two strands of the rope itself *towards you*, leaving a strand of the rope between the place you are now about to tuck it through and where you first commenced to form the cringle; then splice it round the strand next where it comes out, and in doing so half and quarter strand it, sailmaker fashion, which means tucking it under two and over one strand every time you pass it. *(See Fig. 2.)*

In first laying up any cringle, be sure there is an odd number of turns in it before commencing the second tucking, which you may always know by the long strand ending towards you. Very large cringles worked with small strands often require 5 and even 7 turns, but for any ordinary cringle three turns will be quite sufficient, if you wish the cringle to be the same circumference as the rope you are working it into. Cringles so worked ought, if possible, to be served over the splices.

*Figures 3 and 4* in the accompanying plate represent the working of a four-stranded cringle, this description of cringle being the most favoured type amongst sailmakers at the present day. Three-stranded cringles for the leaches and clews of sails, etc., are now nearly obsolete, as a four-stranded cringle is both neater and stronger than a three. Proceed as follows:—

Take a strand and divide it into thirds, place your left side against the rope, and pass through the eyelet hole next to you two-thirds of the strand *from you*, and lay it up precisely as in *Fig. 1;* then pass the

long end A through the eyelet hole furthest to the right *from you*, bring it upwards, and lay it up snugly round the partly-formed cringle towards you; then pass it through the eyelet hole a second time *towards you*, and tuck it under the first two strands of the cringle, as is represented in *Fig. 3*, left side, A.

Now go to the short end of the strand B, lay it over the rope, and pass it through the eyelet hole a second time *from you*, and under the first two strands of the cringle, as represented in *Fig. 3*, B, right side of cringle.

The cringle is now formed, and ready for splicing in the ends of each strand. You may always know if the cringle is formed correctly by each strand forming the outside lay of the cringle at each side; if they do not do so, the cringle is wrongly formed, probably by too many turns being taken in the strands before passing it through the eyelet hole the second time. If such is the case, the cringle must be wholly taken adrift and relayed, and mind in doing so be careful to keep the turns in the strand, or a clumsy, soft cringle will be the result.

Each strand respectively, both A and B, is now tucked over one strand and under two twice, crossing one another near the centre and under side of the cringle, coming out near the top of the cringle, with two strands intervening between the ends, as represented in *Fig. 4*.

The cringle is now fidded well out on a large setting fid, and a thimble placed in it, the ends of the strands being whipped and cut off. Sailmakers often dispense with the whippings, and cut the ends short off, as it is next to impossible in a cringle so made, with a thimble in it, for the ends to draw.

After the cringle is finished, mark the setting fid where it is the full size of the thimble; then beat the cringle down on the fid some little distance below this mark to allow for momentary shrinkage; then capsize the setting fid, and with one blow of the mallet knock the cringle off the fid, and as *quickly as possible* place the thimble on the cringle lying flat on the deck, and hit it a powerful blow with the large end of the fid, which will place the thimble in position without further trouble.

When hammering down a cringle on a setting fid with a powerful mallet, be sure and take a piece of canvas doubled, cut a hole in it, place it on the setting fid above the cringle, to prevent the cringle getting injured by the blows of the mallet.

But to get a large thimble tight and ship-shape into a cringle is only to be come at by practice, and therefore cannot be done to

perfection on a first trial. This the novice will soon find out when he gets fairly to work on his maiden attempt to stick a heavy cringle; but a little perseverance will soon overcome the difficulty, and make him master of the situation.

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## SECTION XXVIII.

# LIGHTS AND FOG SIGNALS.

At present the necessary lights and fog signals for a sailing vessel are side lights, anchor lights, a bright light for showing over the stern to an overtaking ship, two red lights for showing when not under command, a bell, and a mechanical fog-horn.

A steamer, in addition to the above, requires a masthead light, and should she ever tow other vessels, extra masthead lights, and a steam sound signal. In addition to lights and fog signals, all vessels should be provided with means for making black balls or shapes for day signal when not under command.

As to side lights, it is still a fact that, notwithstanding the efforts made by the Board of Trade to keep up their standard, a large number of our coasting vessels carry very inferior lights, which are as a rule not kept in first-rate order. It is open to serious doubt whether the side lights in many coasters will shew even a mile after they have been lit any length of time;* and as large vessels and steamers are also oftentimes defaulters in the same direction, it will be well to point to the most usual defects.

Perhaps the principal cause of inefficiency is the cheap and trumpery burner usually found in lamps which burn petroleum. The most common of these is a wretched affair—(*see Plate No. 101*)—costing twopence, which ships over the passage for the wick, and which is supposed to effect the necessary perfection of combustion to give a good flame without smoke. The results do not come up to the promise, the flame is a miserably smoky one, and lamps fitted with these burners, after a few hours burning, will,

*Plate No. 101.*

* Especially the green light, whose coloured glass obstructs the full light to a greater extent than the red. For the ordinary green lamp to show clearly at 2 miles, it is necessary it should be 28 candle power (a standard sperm candle consumes 120 grains per hour; the best guide, however, is

if opened, generally present a pitiable and disgusting spectacle of smut and smoke. These wretched things are to be found not only in little coasters, but also in large steamers of the general trader class.

This question of burners is a difficult one. There is no doubt that a glass chimney is the best thing, and that with a chimney any ordinary burner will give sufficiently perfect combustion to escape smoke; but chimneys are liable to breakage, and, unless compelled, small vessels would not carry them, and if carrying them, would in many cases not use them. Now, no cheaply made lamps such as are in *general use* are fitted with even decent burners, and it would seem as though, if anyone would invent and manufacture cheaply a fairly efficient burner, he ought to reap a good profit, besides improving the factor of safety at sea. Mr. Harvie, the well-known lamp-maker of Glasgow, has chimneyless burners for Colza oil only, which are in use in a large number of first-class vessels, but unfortunately these are too high in price for the small coasters to buy. This maker does not recommend chimneyless burners for petroleum.

It is to be hoped that the manufacture of glasses which are a *mass of coloured glass* is nearly stopped. These make the best internal flame very dim. Glasses should only have a film of colour on them (or else there should be a thin coloured glass to slip inside a white one), and they should not be corrugated or ridged on the inner surface.

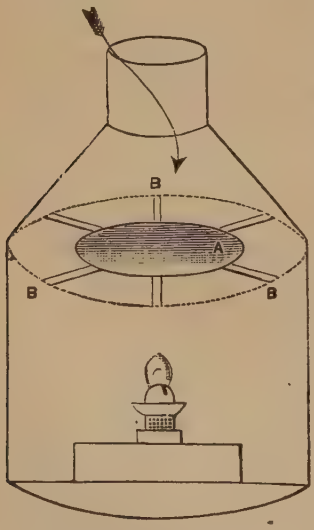



*Plate No. 102.*—A Thin plate fixed in place by strips of metal, B B. B.

Side lights are often seen wrapped up in canvas, like a sick man in flannel. The lamp trimmer will tell you that this is to prevent their being blown out, and many even of the better class of lamps are defective in this point. An easy solution of the difficulty is to have a small plate of thin sheet brass fitted in just below the chimney of the lamp and above the flame (*see Plate No. 102*). A gust of air blowing down in direction of the arrow will then not have sufficient force to do further than make the flame flicker, and will not blow it out. The writer has had several sets of lamps fitted thus, and found them to answer perfectly at sea.

a gas tester). The best lamps of the best makers have far greater power than this, perhaps 4 times; but with an ordinary petroleum burner, a plain lens, and a wick of 1-inch breadth, it is doubtful whether, in the case of the *green* light, the necessary power is reached.

In lamps fitted with dioptric glasses, particular care should be taken when buying the lamps that the focus of flame is exactly in line with the centre of the glass: for this reason, these lamps should not be used indiscriminately for petroleum or colza, as the difference in the burners will make the flames of different heights, and if one is right the other will be wrong. Lamps so fitted are sometimes provided with two grooves for sliding the oil receiver (which carries the burner) into its place, the upper groove to be used when burning colza, the lower when burning petroleum. But this is *not* a satisfactory arrangement, as lamp-trimmers are not to be trusted to see to such minute points, and masters and mates have plenty of other things to occupy their attention.

In cases where lamps are slung in gimbals in towers, care should be taken that the point of suspension (the axis) should coincide with the focus of the flame. But this slinging of lamps seems a needless refinement in steamers, and scarcely worth consideration in sailing vessels, where 12° of list is a large heel under canvas in smooth water. In conclusion, as to side lights, they are, by the regulations, to be visible on a clear night *at least two miles.*

The masthead light being a white light, and not labouring under the disadvantage of a coloured glass, will, if an ordinarily good one, and having a decent reflector, probably shew three or four miles. It is supposed to shew *at least* five miles. It is to be feared that many in use will not do this, simply because petroleum is burnt without a glass chimney, and with a nearly useless burner. In other ways masthead lights in general use are good enough for their purpose.

If lamps had the care bestowed upon them in the general run of vessels which they get in a well-appointed passenger steamer, their general efficiency would be greatly improved; and under such circumstances, if good colza oil were used, most lamps would shew the required distance if the coloured glasses were in order; but, unfortunately, bad trimming and bad oil together often decrease the distance they will shew very considerably. The writer has seen a steamer's masthead light at a distance of thirteen miles.*

Reflectors should be silvered. These should never be touched with brick dust or whiting, but proper polishing paste or a little flour should be used to clean them, and they should be wiped off and polished up with a soft rag or a chamois leather whenever the lamps come in.

It should be remembered that a steamer is bound to carry a fog

* Cera would seem to be a solution of this difficulty; it is cleanly, is authorized by authority and gives general satisfaction where used. Wicks for use with cera should be 1¾ inches in length.

horn as well as a sailing vessel, for if broken down and under sail in a fog she must not blow her whistle. There are numbers of different kinds of horns in the market (the old mouth horn is now seldom seen, except in little coasters, who will persist in carrying them still). Some of these are very good, others very bad; it is a matter of price. Bellows horns are *not* to be recommended, the leather being at the mercy of insects and damp, which soon causes them to become inefficient.

Bells and fog horns are to be "efficient." There is no recognised distance over which they are to be heard in still weather.* It is a question whether nine-tenths of them would be heard a mile away, except in a perfectly still atmosphere. Steamers' whistles are generally effective enough. Sirens are objectionable, and it is a matter for wonder that they are used, when it is considered how deceptive sounds become in a fog, and that our lightships and some shore stations use these same sirens as a fog signal. Whistles should by rights be *before* the funnel. In a great number of steamers they are found at the side, but this arrangement increases the difficulty of locating the sound in a fog; and it is a question whether, if a ship with her whistle in such a position got into collision, she might not be held to blame for this reason. A steam whistle should be so arranged that the valve *will close itself* when the lanyard is let go. Those which depend on a back spring or a weight on the handle to do this are objectionable, and are not nearly of such clear sounding qualities as the others.

To conclude, it is advisable to have the lights and fog signals in such good order and condition that they can, if necessary, be shewn in a Court of Law with every chance of proving their efficiency in every way.

Light towers on the forecastle are in these days "the thing;"† and at present steamers may carry their side-lights anywhere, forward or aft, but it is probable that before long they may have a statutory position with respect to the masthead light, which would be a great improvement.‡

It is a good plan when using the bell to unship it out of the belfry,

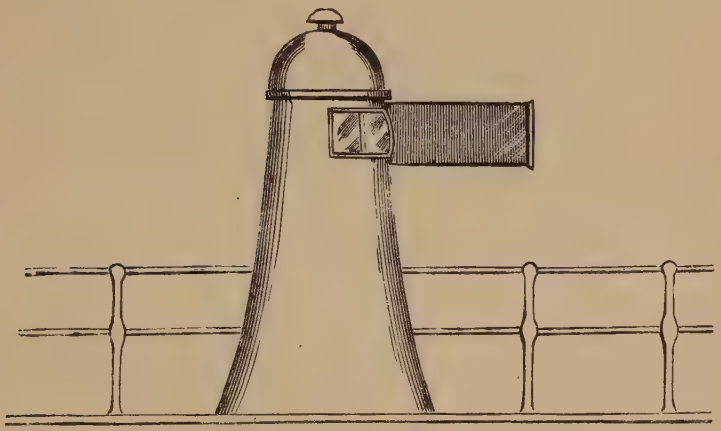
* See page 299.

† Their benefit is however doubtful. The general opinion is that they tend to obscure the light, and it is very probably the case; for, being of iron, they sweat considerably, with the result that moisture is deposited on the glass of the tower.

‡ Most shipmasters consider that the best position for side lights is on the upper (midship) bridge (see an able article by Captain Evans in the *Nautical Magazine* for March, 1896). In this position they give an indication to other vessels as to alteration of helm, and to a great extent show the direction in which the vessel is steering. They are also directly under the eye of the officer of the watch, who need not then rely upon the report of a seaman as to whether they are burning brightly or not,—and they can always be got at for trimming.

and sling it on a stay at a suitable distance off the deck, so that the look-out man can get hold of the lanyard and give it a good rousing peal. With the bell screwed up rigid in its belfry, usually a couple of inches off the deck, the man has to twist himself into all shapes to get at it, with a very poor ring as the result. And if he has to take

*Plate No. 103.—Side Light Tower.*



all this trouble the bell will not be rung often enough, unless he is being constantly sung out to. The writer was on one occasion groping up towards the Nore, with a steamer abreast going the same way, when his companion ran into and sunk a steamer at anchor, who was ringing away at his bell, which was fixed close to the deck at the break of the forecastle. The writer's vessel being a bit ahead, he saw the whole occurrence, but the bell was muffled to the other ship in consequence of its position, the high forecastle obstructing the sound.

Every vessel should have a proper place fitted up for rockets and blue lights, which should be dry, and *ventilated* with small safe holes; in these circumstances they will keep a long time. It is also wise (if this place is not at all times accessible) to have a common box made to go into the chart-room or wheel-house, of sufficient size to hold three rockets and as many blue lights. This box ought also to have holes in it for ventilation, and be placed so that the officer on watch can lay hands on it at a moment's notice. Have the box long enough to take sticks as well, so as not to be running about hunting for staffs when a rocket is wanted. These rockets and blue lights should be frequently examined, and replaced by others if found to be in the

least damp, as a damp rocket is dangerous to fire off, being liable to explode. It is well to fire off one of your stock occasionally in the day time to see they keep their condition. Do not test them at night time, as you do not know who may be near the ship, and it might raise a false alarm, and put your vessel to expense for offered assistance that she would not require.

*Red* pyrotechnic lights are dangerous, and should not be carried.

The patent "Socket Distress Signals" are very handy and efficient, and are authorized for use in lieu of guns or rockets.

When purchasing rockets and blue lights, remember that the maker is bound to have the date of their manufacture on them; therefore, look for this mark, and refuse any but *new* stock. Rockets on board ship, even when kept in a suitable place, cannot be depended on for more than twelve months.

Frictional signal lights, or Roman candles, require care in handling, should be kept in a separate box, and should not be knocked about.

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## REGULATIONS FOR PREVENTING COLLISIONS AT SEA.

### In force on and after 1st July, 1897.

### *Preliminary.*

These Rules shall be followed by all vessels upon the high seas and in all waters connected therewith, navigable by sea-going vessels.

In the following Rules every steam vessel which is under sail and not under steam is to be considered a sailing vessel, and every vessel under steam, whether under sail or not, is to be considered a steam vessel.

The word "steam vessel" shall include any vessel propelled by machinery.

A vessel is "under way" within the meaning of these Rules when she is not at anchor, or made fast to the shore, or aground.

### *Rules concerning Lights, &c.*

The word "visible" in these Rules, when applied to lights, shall mean visible on a dark night with a clear atmosphere.

Art. 1. The Rules concerning lights shall be complied with in all weathers from sunset to sunrise, and during such time no other lights which may be mistaken for the prescribed lights shall be exhibited.

Art. 2. A steam vessel when under way shall carry—

(*a.*) On or in front of the foremast, or if a vessel without a foremast, then in the fore part of the vessel, at a height above the hull of not less than 20 feet, and if the breadth of the vessel exceeds 20 feet, then at a height above the hull not less than such breadth, so, however, that the light need not be carried at a greater height above the hull than 40 feet, a bright white light, so constructed as to show an unbroken light over an arc of the horizon of 20 points of the compass, so fixed as to throw the light 10

points on each side of the vessel, viz, from right ahead to 2 points abaft the beam on either side, and of such a character as to be visible at a distance of at least 5 miles.

(*b.*) On the starboard side a green light so constructed as to show an unbroken light over an arc of the horizon of 10 points of the compass, so fixed as to throw the light from right ahead to 2 points abaft the beam on the starboard side, and of such a character as to be visible at a distance of at least 2 miles.

(*c.*) On the port side a red light so constructed as to show an unbroken light over an arc of the horizon of 10 points of the compass, so fixed as to throw the light from right ahead to 2 points abaft the beam on the port side, and of such a character as to be visible at a distance of at least 2 miles.

(*d.*) The said green and red side lights shall be fitted with inboard screens projecting at least 3 feet forward from the light, so as to prevent these lights from being seen across the bow.

(*e.*) A steam vessel when under way may carry an additional white light similar in construction to the light mentioned in subdivision (*a*). These two lights shall be so placed in line with the keel that one shall be at least 15 feet higher than the other, and in such a position with reference to each other that the lower light shall be forward of the upper one. The vertical distance between these lights shall be less than the horizontal distance.

Art. 3. A steam vessel when towing another vessel shall, in addition to her side lights, carry two bright white lights in a vertical line one over the other, not less than six feet apart, and when towing more than one vessel shall carry an additional bright white light 6 feet above or below such lights, if the length of the tow, measuring from the stern of the towing vessel to the stern of the last vessel towed, exceeds 600 feet. Each of these lights shall be of the same construction and character, and shall be carried in the same position as the white light mentioned in Article 2 (*a*), except the additional light, which may be carried at a height of not less than 14 feet above the hull.

Such steam vessel may carry a small white light abaft the funnel or aftermast for the vessel towed to steer by, but such light shall not be visible forward of the beam.

Art. 4. (*a.*) A vessel which from any accident is not under command, shall carry at the same height as the white light mentioned in Article 2 (*a*), where they can best be seen, and, if a steam vessel, in lieu of that light, *two* red lights, in a vertical line one over the other, not less than *six* feet apart, and of such a character as to be visible all round the horizon at a distance of at least 2 miles ; and shall by day carry in a vertical line one over the other, not less than *six* feet apart, where they can best be seen, *two* black balls or shapes, each 2 feet in diameter.

(*b.*) A vessel employed in laying or in picking up a telegraph cable shall carry in the same position as the white light mentioned in Article 2 (*a*), and, if a steam vessel, in lieu of that light, three lights in a vertical line one over the other, not less than 6 feet apart. The highest and lowest of these lights shall be red, and the middle light shall be white, and they shall be of such a character as to be visible all round the horizon at a distance of at least 2 miles. By day she shall carry in a vertical line one over the other, not less than 6 feet apart, where they can best be seen, three shapes not less than 2 feet in diameter, of which the highest and lowest shall be globular in shape and red in colour, and the middle one diamond in shape and white.

(*c.*) The vessels referred to in this Article, when not making way through the water, shall not carry the side lights, but when making way shall carry them.

(*d.*) The lights and shapes required to be shown by this Article are to be taken by other vessels as signals that the vessel showing them is not under command, and cannot therefore get out of the way.

These signals are not signals of vessels in distress and requiring assistance. Such signals are contained in Article 31.

Art. 5. A sailing vessel under way, and any vessel being towed, shall carry the same lights as are prescribed by Article 2 for a steam vessel under way, with the exception of the white lights mentioned therein, which they shall never carry.

Art. 6. Whenever, as in the case of small vessels under way during bad weather, the green and red side lights cannot be fixed, these lights shall be kept at hand lighted and ready for use ; and shall, on the approach of or to other vessels, be exhibited on their respective sides in sufficient time to prevent collision, in such manner as to make them most visible, and so that the green light shall not be seen on the port side nor the red light on the starboard side, nor, if practicable, more than 2 points abaft the beam on their respective sides.

To make the use of these portable lights more certain and easy, the lanterns containing them shall each be painted outside with the colour of the light they respectively contain, and shall be provided with proper screens.

Art. 7. Steam vessels of less than 40, and vessels under oars or sails of less than 20 tons gross tonnage, respectively, and rowing boats, when under way, shall not be obliged to carry the lights mentioned in Article 2 (*a*) (*b*) and (*c*), but if they do not carry them they shall be provided with the following lights : -

1. Steam vessels of less than 40 tons shall carry—

(*a.*) In the fore part of the vessel, or on or in front of the funnel, where it can best be seen, and at a height above the gunwale of not less than 9 feet, a bright white light constructed and fixed as prescribed in Article 2 (*a*), and of such a character as to be visible at a distance of at least 2 miles.

(*b.*) Green and red side-lights constructed and fixed as prescribed in Article 2 (*b*) and (*c*), and of such a character as to be visible at a distance of at least 1 mile, or a combined lantern showing a green light and a red light from right ahead to 2 points abaft the beam on their respective sides. Such lantern shall be carried not less than 3 feet below the white light.

2. Small steamboats, such as are carried by sea-going vessels, may carry the white light at a less height than 9 feet above the gunwale, but it shall be carried above the combined lantern, mentioned in subdivision 1 (*b*).

3. Vessels under oars or sails, of less than 20 tons, shall have ready at hand a lantern with a green glass on one side and a red glass on the other, which, on the approach of or to other vessels, shall be exhibited in sufficient time to prevent collision, so that the green light shall not be seen on the port side nor the red light on the starboard side.

4. Rowing boats, whether under oars or sail, shall have ready at hand a lantern showing a white light, which shall be temporarily exhibited in sufficient time to prevent collision.

The vessels referred to in this Article shall not be obliged to carry the lights prescribed by Article 4 (*a*), and Article 11, last paragraph.

Art. 8. Pilot vessels, when engaged on their station on pilotage duty, shall not show the lights required for other vessels, but shall carry a white light at the mast

head visible all round the horizon, and shall also exhibit a flare-up light or flare-up lights at short intervals, which shall never exceed fifteen minutes.

On the near approach of or to other vessels they shall have their side-lights lighted, ready for use, and shall flash or show them at short intervals, to indicate the direction in which they are heading, but the green light shall not be shown on the port side, nor the red light on the starboard side.

A pilot-vessel of such a class as to be obliged to go alongside of a vessel to put a pilot on board, may show the white light instead of carrying it at the masthead, and may, instead of the coloured lights above mentioned, have at hand ready for use a lantern with a green glass on the one side and a red glass on the other, to be used as prescribed above.

A steam pilot-vessel exclusively employed for the service of pilots licensed or certified by any pilotage authority or the Committee of any pilotage district, when engaged on her station on pilotage duty and not at anchor, shall, in addition to the lights required for all pilot boats, carry at a distance of eight feet below her white masthead light a red light visible all round the horizon and of such a character as to be visible on a dark night with a clear atmosphere at a distance of at least two miles, and also the coloured side-lights required to be carried by vessels when under way.

When engaged on her station on pilotage duty and at anchor she shall carry, in addition to the lights required for all pilot boats, the red light above mentioned, but not the coloured side-lights.

Pilot-vessels, when not engaged on their station on pilotage duty, shall carry lights similar to those of other vessels of their tonnage.

Article 9.*† Fishing-vessels and fishing-boats, when under way and when not required by this Article to carry or show the lights herein-after specified shall carry or show the lights prescribed for vessels of their tonnage under way.

(*a.*) Open boats, by which it is to be understood boats not protected from the entry of sea water by means of a continuous deck, when engaged in any fishing at night with outlying tackle extending not more than 150 feet horizontally from the boat into the seaway, shall carry one all-round white light.

Open boats, when fishing at night, with outlying tackle extending more than 150 feet horizontally from the boat into the seaway, shall carry one all-round white light, and in addition, on approaching or being approached by other vessels, shall show a second white light at least 3 feet below the first light and at a horizontal distance of at least 5 feet away from it in the direction in which the outlying tackle is attached.

(*b.*)‡ Vessels and boats, except open boats as defined in sub-division (*a*), when fishing with drift-nets, shall, so long as the nets are wholly or partly in the water, carry two white lights where they can best be seen. Such lights shall be placed so that the vertical distance between them shall be not less than 6 feet and not more than 15 feet, and so that the horizontal distance between them measured in a line with the keel, shall be not less than 5 feet and not more than 10 feet. The lower of these two lights shall be in the

* This article does not apply to Chinese or Siamese vessels.

† The expression "Mediterranean Sea" contained in sub-sections (*b*) and (*c*) of this Article includes the Black Sea and the other adjacent inland seas in communication with it

‡ Dutch vessels and boats when engaged in the "kol," or hand-line fishing, will carry the lights prescribed for vessels fishing with drift nets.

direction of the nets, and both of them shall be of such a character as to show all round the horizon, and to be visible at a distance of not less than 3 miles.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea* sailing fishing vessels of less than 20 tons gross tonnage shall not be obliged to carry the lower of these two lights; should they, however, not carry it, they shall show in the same position (in the direction of the net or gear) a white light, visible at a distance of not less than one sea mile, on the approach of or to other vessels.

(*c.*) Vessels and boats, except open boats as defined in sub-division (*a*), when line-fishing with their lines out and attached to or hauling their lines, and when not at anchor or stationary within the meaning of sub-division (*h*), shall carry the same lights as vessels fishing with drift-nets. When shooting lines, or fishing with towing lines, they shall carry the lights prescribed for a steam or sailing vessel under way respectively.

Within the Mediterranean Sea and in the seas bordering the coasts of Japan and Korea† sailing fishing vessels of less than 20 tons gross tonnage shall not be obliged to carry the lower of these two lights; should they, however, not carry it, they shall show in the same position (in the direction of the lines) a white light, visible at a distance of not less than one sea mile on the approach of or to other vessels.

(*d.*) Vessels, when engaged in trawling, by which is meant the dragging of an apparatus along the bottom of the sea—

1. If steam vessels, shall carry in the same position as the white light mentioned in Article 2 (*a*) a tricoloured lantern so constructed and fixed as to show a white light from right ahead to two points on each bow, and a green light and a red light over an arc of the horizon from two points on each bow to two points abaft the beam on the starboard and port sides respectively; and not less than 6 nor more than 12 feet below the tricoloured lantern a white light in a lantern, so constructed as to show a clear, uniform and unbroken light all round the horizon.

2. If sailing vessels, shall carry a white light in a lantern, so constructed as to show a clear, uniform and unbroken light all round the horizon, and shall also, on the approach of or to other vessels, show where it can best be seen a white flare-up light or torch in sufficient time to prevent collision.

All lights mentioned in sub-division (*d*) 1 and 2 shall be visible at a distance of at least 2 miles.

(*e.*) Oyster dredgers and other vessels fishing with dredge-nets shall carry and show the same lights as trawlers.

(*f.*) Fishing-vessels and fishing-boats may at any time use a flare-up light in addition to the lights which they are by this Article required to carry and show, and they may also use working lights.

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* Also, as regards Russian vessels, in the seas (excluding the Baltic) bordering the coasts of Russia.

(*g.*) Every fishing-vessel and every fishing-boat under 150 feet in length, when at anchor, shall exhibit a white light visible all round the horizon at a distonce of at least one mile.

Every fishing-vessel of 150 feet in length or upwards, when at anchor, shall exhibit a white light visible all round the horizon at a distance of at least one mile, and shall exhibit a second light as provided for vessels of such length by Article 11.

Should any such vessel, whether under 150 feet in length, or of 150 feet in length or upwards, be attached to a net or other fishing gear, she shall on the approach of other vessels show an additional white light at least 3 feet below the anchor light, and at a horizontal distance of at least 5 feet away from it in the direction of the net or gear.

(*h.*) If a vessel or boat when fishing becomes stationary in consequence of her gear getting fast to a rock or other obstruction, she shall in daytime haul down the day-signal required by sub-division (*k*); at night show the light or lights prescribed for a vessel at anchor; and during fog, mist, falling snow, or heavy rain-storms make the signal prescribed for a vessel at anchor. (See sub-division (*d*), and the last paragraph, of Article 15.)

(*i.*) In fog, mist, falling snow, or heavy rain-storms, drift-net vessels attached to their nets, and vessels when trawling, dredging, or fishing with any kind of dragnet, and vessels line fishing with their lines out shall, if of 20 tons gross tonnage or upwards, respectively, at intervals of not more than one minute make a blast; if steam vessels, with the whistle or siren, and if sailing vessels with the fog-horn; each blast to be followed by ringing the bell. Fishing vessels and boats of less than 20 tons gross tonnage shall not be obliged to give the above-mentioned signals; but if they do not, they shall make some other efficient sound signal at intervals of not more than one minute.

(*k.*) All vessels or boats fishing with nets or lines or trawls, when under way, shall in daytime indicate their occupation to an approaching vessel by displaying a basket or other efficient signal where it can best be seen. If vessels or boats at anchor have their gear out, they shall, on the approach of other vessels, show the same signal on the side on which those vessels can pass.

The vessels required by this Article to carry or show the lights here-before specified shall not be obliged ts carry the lights prescribed by Article 4 (*a*), and the last paragraph of Article 11.

Art. 10. A vessel which is being overtaken by another shall show from her stern to such last-mentioned vessel a white light or a flare-up light.

The white light required to be shown by this Article may be fixed and carried in a lantern, but in such case the lantern shall be so constructed, fitted, and screened that it shall throw an unbroken light over an arc of the horizon, of 12 points of the compass, viz., for 6 points from right aft on each side of the vessel, so as to be visible at a distance of at least 1 mile. Such light shall be carried as nearly as practicable on the same level as the side-lights.

Art. 11. A vessel under 150 feet in length, when at anchor, shall carry forward, where it can best be seen, but at a height not exceeding 20 feet above the hull, a white light in a lantern so constructed as to show a clear, uniform, and unbroken light visible all round the horizon at a distance of at least 1 mile.

A vessel of 150 feet or upwards in length, when at anchor, shall carry in the forward part of the vessel, at a height of not less than 20, and not exceeding 40 feet above the hull, one such light, and at or near the stern of the vessel, and at such a height that it shall not be less than 15 feet lower than the forward light, another such light.

The length of a vessel shall be deemed to be the length appearing in her certificate of registry.

A vessel aground in or near a fairway shall carry the above light or lights and the two red lights prescribed by Article 4 (*a*).

Art. 12. Every vessel may, if necessary in order to attract attention, in addition to the lights which she is by these Rules required to carry, show a flare-up light or use any detonating signal that cannot be mistaken for a distress signal.

Art. 13. Nothing in these Rules shall interfere with the operation of any special rules made by the Government of any nation with respect to additional station and signal lights for two or more ships of war or for vessels sailing under convoy, or with the exhibition of recognition signals adopted by shipowners, which have been authorised by their respective Governments and duly registered and published.

Art. 14. A steam vessel proceeding under sail only, but having her funnel up shall carry in daytime, forward, where it can best be seen, one black ball or shape 2 feet in diameter.

*Sound Signals for Fog, &c.*

Art. 15. All signals prescribed by this Article for vessels under way shall be given:

1. By "steam vessels" on the whistle or siren.
2. By "sailing vessels and vessels towed" on the fog-horn.

The words "prolonged blast" used in this Article, shall mean a blast of from 4 to 6 seconds duration.

A steam vessel shall be provided with an efficient whistle or siren, sounded by steam or some substitute for steam, so placed that the sound may not be intercepted by any obstruction, and with an efficient fog-horn, to be sounded by mechanical means, and also with an efficient bell.* A sailing vessel of 20 tons gross tonnage or upwards shall be provided with a similar fog-horn and bell.

In fog, mist, falling snow, or heavy rain storms, whether by day or night, the signals described in this Article shall be used as follows, viz. :—

(*a.*) A steam vessel having way upon her, shall sound, at intervals of not more than 2 minutes, a prolonged blast.

(*b.*) A steam vessel under way, but stopped and having no way upon her, shall sound, at intervals of not more than 2 minutes, 2 prolonged blasts, with an interval of about 1 second between them.

(*c.*) A sailing vessel under way shall sound, at intervals of not more than one minute, when on the starboard tack one blast, when on the port tack two blasts in succession, and when with the wind abaft the beam three blasts in succession.

(*d.*) A vessel, when at anchor, shall, at intervals of not more than one minute, ring the bell rapidly for about five seconds.

(*e.*) A vessel, when towing, a vessel employed in laying or in picking up a telegraph cable, and a vessel under way, which is unable to get out of the way of an approaching vessel through being not under command, or unable to manœuvre as required by these Rules shall, instead of the signals prescribed

† Dutch steam pilot-vessels, when engaged on their station on pilotage duty in fog, mist, falling snow, or heavy rain-storms are required to make at intervals of 2 minutes at most one long blast with the siren, followed after 1 second by a long blast with the steam whistle and again after 1 second by a long blast on the siren When not engaged on their station on pilotage duty, they make the same signals as other steamships.

in sub-divisions (*a*) and (*c*) of this Article, at intervals of not more than two minutes, sound three blasts in succession, viz. : one prolonged blast followed by two short blasts. A vessel towed may give this signal and she shall not give any other.

Sailing vessels and boats of less than 20 tons gross tonnage shall not be obliged to give the above-mentioned signals, but if they do not, they shall make some other efficient sound-signal at intervals of not more than 1 minute.

*Speed of Ships to be moderate in Fog, &c.*

Art. 16. Every vessel shall, in a fog, mist, falling snow, or heavy rain storms, go at a moderate speed, having careful regard to the existing circumstances and conditions.

A steam-vessel hearing, apparently forward of her beam, the fog-signal of a vessel the position of which is not ascertained, shall, so far as the circumstances of the case admit, stop her engines, and then navigate with caution until danger of collision is over

## Steering and Sailing Rules.

*Preliminary—Risk of Collision.*

Risk of collision can, when circumstances permit, be ascertained by carefully watching the compass bearing of an approaching vessel. If the bearing does not appreciably change, such risk should be deemed to exist.

Art 17. When two sailing vessels are approaching one another, so as to involve risk of collision, one of them shall keep out of the way of the other, as follows, viz. :

(*a.*) A vessel which is running free shall keep out of the way of a vessel which is close-hauled.

(*b.*) A vessel which is close-hauled on the port tack shall keep out of the way of a vessel which is close-hauled on the starboard tack.

(*c.*) When both are running free, with the wind on different sides, the vessel which has the wind on the port side shall keep out of the way of the other.

(*d.*) When both are running free, with the wind on the same side, the vessel which is to windward shall keep out of the way of the vessel which is to leeward.

(*e.*) A vessel which has the wind aft shall keep out of the way of the other vessel.

Art. 18. When two steam vessels are meeting end on, or nearly end on, so as to involve risk of collision, each shall alter her course to starboard, so that each may pass on the port side of the other.

This Article only applies to cases where vessels are meeting end on, or nearly end on, in such a manner as to involve risk of collision, and does not apply to two vessels which must, if both keep on their respective courses, pass clear of each other.

The only cases to which it does apply are, when each of the two vessels is end on, or nearly end on, to the other ; in other words, to cases in which, by day, each vessel sees the masts of the other in a line, or nearly in a line, with her own ; and by night, to cases in which each vessel is in such a position as to see both the side lights of the other.

It does not apply, by day, to cases in which a vessel sees another ahead crossing her own course ; or by night, to cases where the red light of one vessel is opposed to the red light of the other, or where the green light of one vessel is opposed to the green light of the other, or where a red light without a green light, or a green light without a red light, is seen ahead, or where both green and red lights are seen anywhere but ahead.

Art. 19. When two steam-vessels are crossing, so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way of the other.

* In all cases where the Rules require a bell to be used a drum may be substituted on board Turkish vessels, or a gong where such articles are used on board small sea-going vessels.

Art. 20. When a steam-vessel and a sailing-vessel are proceeding in such directions as to involve risk of collision, the steam-vessel shall keep out of the way of the sailing-vessel.

Art. 21. Where by any of these Rules one of two vessels is to keep out of the way, the other shall keep her course and speed.

NOTE.—When, in consequence of thick weather or other causes, such vessel finds herself so close that collision cannot be avoided by the action of the giving-way vessel alone, she also shall take such action as will best aid to avert collision. (See Articles 27 and 29.)

Art. 22. Every vessel which is directed by these Rules to keep out of the way of another vessel shall, if the circumstances of the case admit, avoid crossing ahead of the other.

Art. 23. Every steam-vessel which is directed by these Rules to keep out of the way of another vessel shall, on approaching her, if necessary, slacken her speed or stop or reverse.

Art. 24. Notwithstanding anything contained in these Rules, every vessel, overtaking any other, shall keep out of the way of the overtaken vessel.

Every vessel coming up with another vessel from any direction more than two points abaft her beam, *i.e.*, in such a position, with reference to the vessel which she is overtaking that at night she would be unable to see either of that vessel's side-lights, shall be deemed to be an overtaking vessel ; and no subsequent alteration of the bearing between the two vessels shall make the overtaking vessel a crossing vessel within the meaning of these Rules, or relieve her of the duty of keeping clear of the overtaken vessel until she is finally past and clear.

As by day the overtaking vessel cannot always know with certainty whether she is forward of or abaft this direction from the other vessel, she should, if in doubt, assume that she is an overtaking vessel and keep out of the way.

Art 25. In narrow channels every steam-vessel shall, when it is safe and practicable, keep to that side of the fairway or mid channel which lies on the starboard side of such vessel.

Art. 26. Sailing-vessels under way shall keep out of the way of sailing-vessels or boats fishing with nets, or lines, or trawls. This Rule shall not give to any vessel or boat engaged in fishing the right of obstructing a fairway used by vessels other than fishing vessels or boats.

Art. 27. In obeying and construing these Rules, due regard shall be had to all dangers of navigation and collision, and to any special circumstances which may render a departure from the above Rules necessary in order to avoid immediate danger.

*Sound Signals for Vessels in Sight of one another.*

Art. 28. The words "short blast" used in this Article shall mean a blast of about one second's duration.

When vessels are in sight of one another, a steam-vessel under way, in taking any course authorised or required by these Rules, shall indicate that course by the following signals on her whistle or siren, viz. :—

One short blast to mean, "I am directing my course to starboard."

Two short blasts to mean, "I am directing my course to port."

Three short blasts to mean, "My engines are going full speed astern."

*No Vessel under any circumstances to neglect proper Precautions.*

Art. 29. Nothing in these Rules shall exonerate any vessel, or the owner, or master, or crew thereof, from the consequences of any neglect to carry lights or signals, or of any neglect to keep a proper look-out, or of the neglect of any precaution which may be required by the ordinary practice of seamen, or by the special circumstances of the case.

*Reservation of Rules for Harbours and Inland Navigation.*

Art. 30. Nothing in these Rules shall interfere with the operation of a special rule, duly made by local authority, relative to the navigation of any harbour, river, or inland waters.

## SCHEDULE II.

*Distress Signals.*

Art. 31. When a vessel is in distress and requires assistance from other vessels or from the shore, the following shall be the signals to be used or displayed by her, either together or separately, viz. :—

In the daytime—

1. A gun or other explosive signal fired at intervals of about a minute ;
2. The International Code signal of distress indicated by N.C. ;
3. The distant signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball ;
4. A continuous sounding with any fog-signal apparatus.

At night

1. A gun or other explosive signal fired at intervals of about a minute ;
2. Flames on the vessel (as from a burning tar-barrel, oil-barrel, &c.) ;
3. Rockets or shells, throwing stars of any colour or description, fired one at a time, at short intervals ;
4. A continuous sounding with any fog-signal apparatus.

## NEW ARTICLE No. 21.

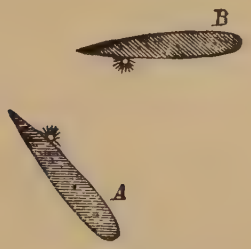


*Plate No. 104.*

In such a case as this, when *A* has only seen *B* at the last moment, she must *not* merely port her helm, or she will run aboard of *B* : she should go full speed astern.* In this case *B* must also act (see note after Art. 21 and Arts. 27 and 29). It would not be enough for *A* to starboard her helm, as it would (probably) not avert collision : she must use the precautions best suited to the case. So also must *B* in this instance (note after Art. 21).

* Unless too close. (See page 322.)

## NEW ARTICLE No. 22.

*Plate No. 105.*

Under the old rules *A* might, if judgment said it was proper, go in the direction of the arrow. This is now unlawful by Art. 22

She must now act thus, unless the circumstances of the case do not admit it.
*B* keeps course and speed.

Thus, to starboard to a red light on your starboard side will be unlawful, unless there is good reason to suppose that so doing would *not* take you across the bow of the other ship.

Generally speaking, all helm movements tending to cross at right angles are now wrong; all tending to put the two vessels end on, or on opposite courses, are right.

The holding-on ship must keep her speed. But at close quarters she must take such action as will best aid to avert collision.

The keeping-away vessel must go under the stern of the other.

The keeping-away vessel is also ordered to slacken speed if necessary.

A steamer *may* carry (but is *not* obliged to carry) a second masthead light.

A steamer towing more than one vessel *must* carry three masthead lights, if the full length of the tow is over 600 feet.

A steamer carrying a stern light must screen it so that it cannot be seen more than 6 points from right aft.

A vessel of 150 feet long or more must carry two anchor lights, the after one 15 feet lower than the fore one.

A steamer stopped with no way on her must sound 2 long blasts—with 1 second's interval between them.

A steamer towing, or on cable work, or not under command, must sound 1 long, 2 short

## RULE OF THE ROAD FOR STEAMSHIPS.

TWO STEAMSHIPS MEETING.

When all three lights I see a-head,
I port my helm and show my RED.

---

TWO STEAMSHIPS PASSING CLEAR.

*Green* to *Green*, or *Red* to *Red*,
Perfect safety, go a-head.

---

The importance of the subject cannot be over-estimated; the more thoroughly a young seaman masters the Rule of the Road in all its phases, the more valuable a servant he becomes to his employers. But it must be remembered that the *chief* means to this end is actual practice; nothing else will make an officer fit to be trusted with the charge of a vessel.

---

The 4° crossing angle for side-lights has been abolished, and the present rule for screening these lights is as follows:—

The screen to be parallel to the fore and aft line of keel, and to be three feet in length forward of the flame of the lamp.

The chock at forward end of screen to be in a line with the inside edge of the wick (or filament).

The breadth of wick (or filament) to be not more than 2 inches or less than 1 inch, measured at right angles to the fore and aft line.

With wicks of any breadth (between 1 inch and 2 inches) the screening is the same, the *inner* edge of the wick being the screening point.

The 1-inch wick W must be kept in this position, *i.e.*, at right angles to the fore and aft line. It must not be *less* than 1 inch broad, nor *more* than 2 inches.

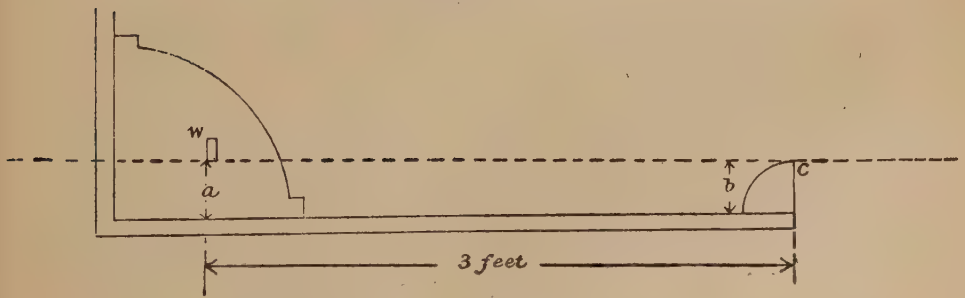


*Plate No. 106.*

The chock C must stand at the same distance off the fore and aft edge of the screen as the *inner* edge of the wick does, *i.e.*, distance *a* = distance *b*

In the case of a 2-inch wick (or filament) the actual flame when coming into view will be seen across the bows at an angle of 3° 11′; with a 1-inch wick the angle of crossing will be 1° 35′. Thus, though the 4° angle has been reduced, lights screened by the new rule will still be seen on the opposite bow, the average crossing angle being now 2° instead of 4°.

---

This matter of Lights and Fog Signals is the one which has most exercised the minds of nautical men in the last few years. It is, undoubtedly, a most important part of a seaman's education. Had seamen generally possessed a more intimate acquaintance with the subject in all its bearings, it is probable their voice would have been heard to better advantage in the controversy. What the seaman appears to ask for now is as follows:—

A position for steamer's side-lights defined by authority; this should be on the *upper* bridge amidships, and a good distance abaft the masthead light The carrying at all times of the stern light to be legalised.

This was the recommendation of the Sub-Committee at Washington, which had the subject of steamers' lights under consideration.

To the seaman it appears that any system of intricacy condemns itself; he knows that there are, at sea, and always must be, men who are not highly educated, and are of a careless disposition. Such men will only learn what they are forced to, and would not handle an intricate system either of Light or Fog Signals with intelligence; it is to the level of this class at which legislation must be aimed, especially when it is considered that our *best* merchant seamen advocate similar ideas. *

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## SECTION XXIX.

## BOATS.

Boats as a rule are very much neglected on board ships, and it is only here and there that a master is found who insists on his boats being kept in good order, and ready for putting over quickly. Even in many passenger steamers the boats will be found lying comfortably in the chocks, the tackles slacked down, and the falls coiled away in the boats, covers carefully laced over all, and the gripes lashed up, in many cases without any kind of disengaging link on them. The writer of this article has several times been passenger on board steamers where for the whole voyage the boats were in this condition, not even one of

*Numerous machines and systems for signalling courses in fog have been invented; nearly all of them are too intricate for use at sea, though, of course, their inventors do not think so. It might, however, be possible to arrange a system of three signals for the principal ocean highways. I. I am bound *up*, or homeward. II. I am bound *down*, or outward. III. I am crossing the channel. Codes with eight, or more, signals may at once be dismissed as impracticable.

them being in the davits ready for a case of emergency, such as a man overboard. In most first-class lines, and in isolated cases outside of them, the very reverse of this system obtains; and it may be well to mention, first of all, the way boats are managed in these cases. When preparing for sea the disengaging hooks are overhauled, and seen in working order (if left any length of time some of these patent hooks set fast). The davit falls are examined, life-lines are fitted to each davit head, and, in some cases, two or three more along the span. Breakers are cleaned out and re-filled; the galvanized iron or tin biscuit lockers are emptied, re-filled with fresh biscuit, and secured as nearly as possible air tight; the sails are taken out of their covers, and, if damp, set to dry; plugs, bailers, tiller, rowlocks or thowl pins, and hatchets (of which there is one at each end of the boat) are all looked to, and the boat is then re-covered (but these covers are so fitted that they can be cast off in a moment).* The boats are then hoisted out of the chocks and left hanging in the tackles. As soon as the vessel is out of dock, one of the smaller boats is swung out and griped to with self-disengaging gripes, the falls coiled down clear, and the painter passed forward and made fast. If going on a fine weather voyage the boats will (when the vessel is fairly steady) be all swung out, and left so, ready for any sudden emergency. The ship's company will be told off into boat's crews.

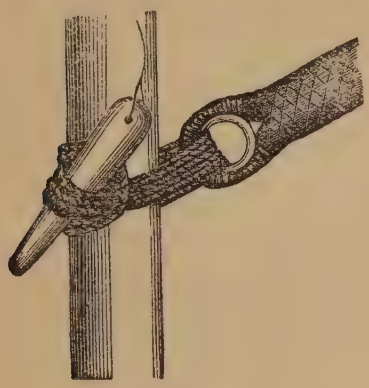
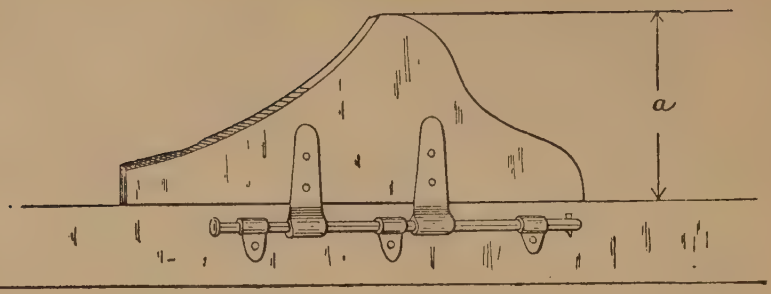


*Plate No. 107.*

Method for detaching boat's gripes when carried swung out, used in some of the mail services. Fitted thus the toggle will not jam, no matter how much strain there may be on the gripe; it should be kept slightly soaped.

During the voyage the boats will be well wetted with the hose every morning when the decks are washed, and on the occasion of fire and boat drill, will be overhauled by the officers in charge of them. How very different to this is the procedure with regard to boats in the ordinary cargo steamer; they are there too often neglected year after year, and left lying in the chocks, till, as the writer lately saw in a comparatively new vessel, they had actually, through water being allowed to lie in them, sunk into the chocks to such an extent that they were absolutely useless wrecks.

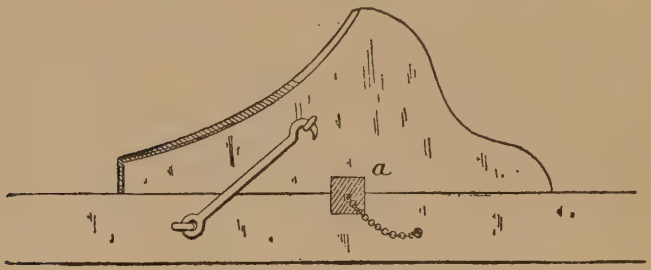
* Boat covers are a modern invention, and are supposed to be good for the boats, protecting them in hot weather. This is doubtful. Boats uncovered get some water put into them every morning when the decks are washed, covered boats are always *dry*. Uncovered boats are ready for instant use: covered boats are *not*.




A BOAT'S CHOCK ON SLIDING-OUT HINGE.

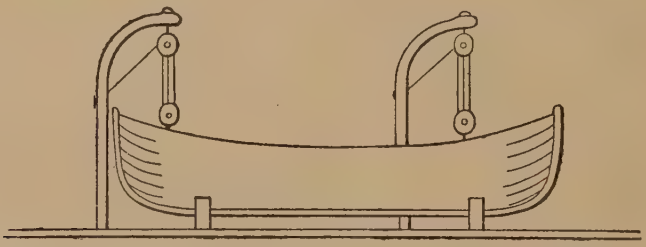
When the tackles are hauled taut the chock can be drawn out, and the boat is at once ready for launching.

If hinged chocks are fitted to supports which only rise a short distance above the deck, the distance from the deck to the upper edge of the support should never be less than distance *a*, or the chock will not turn over clear.

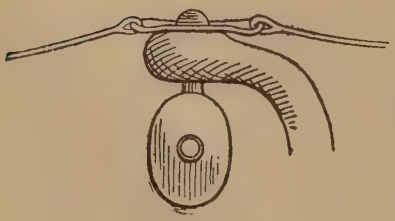



A BOAT'S CHOCK KEYED TO THE SKID.

The key (*a*), slightly tapered one way, is knocked out, and the chock can then be drawn out.



Boats on chocks are best placed, with regard to davits, thus—the davits raking aft, and the boat's bow just clear of the forward davit. The boat in this position can be launched out at once, as soon as free from her chocks, without it being first necessary to launch her forward or aft.



Davit spans should always be fitted thus. If fitted *under* the davit head (as is often the case) they foul every time the davit is swung, and have to be dipped round.

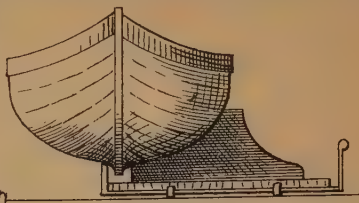
*Plate No. 108.*

The boats lie in movable chocks, fitted to slide either way on wooden ways, so that in the event of a "list" they can all be got out on the lee side one after another.

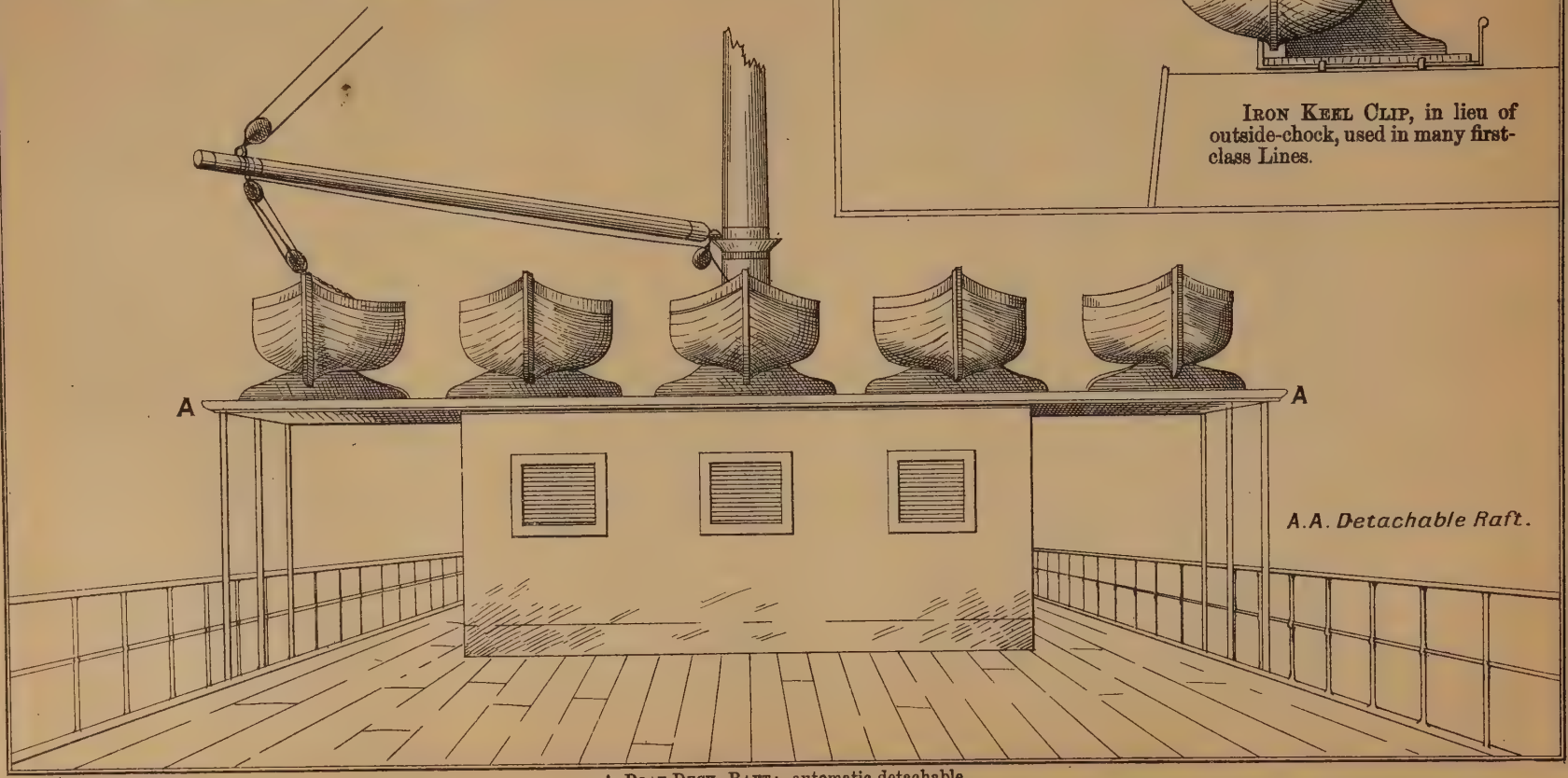
The derrick swings on a revolving collar, so that it can be used on either side.

The fall leads to a winch abaft the house.

As soon as the hand-lever is turned over the boat is free; with outside chocks it would have to be lifted to get the chocks turned over.



IRON KEEL CLIP, in lieu of outside-chock, used in many first-class Lines.




A BOAT-DECK RAFT; automatic-detachable.

To be easily detachable from the supporting deck. In smooth water it should be *kept detached*, so that in case of sudden foundering it and the boats will float away from the sinking vessel.

There is no reason why every vessel should not have at least one lifeboat fitted with lowering gear or disengaging hooks and self-detaching gripes, and keep this boat swung out and ready for lowering the whole voyage, except when the weather is too severe. If this were the general practice, many a poor fellow would now be alive who has been drowned, simply because it took too long to clear away a boat to get at him.

As to carrying boats swung out, many seamen in these days have a notion that this is an impossibility; but the old Blackwall ships, trading to India and Australia, *always* carried their boats out the whole voyage. One of these was generally fitted with Clifford's lowering gear, and it was seldom necessary to hook the falls on to a boat thus fitted, or in any way use any extra precautions, except in very heavy weather, when they were hoisted close up to the davit heads, and perhaps an extra lashing passed round bow and stern. In one of these ships, when the writer was a young officer, two lives were saved on one passage owing to this custom. The first time the man went overboard, when the ship was going some 9 knots on a bowline down the S.E. trades, the boat, fitted with Clifford's gear, was manned with a rush by those on deck, and run down at once into the water, long before the ship's way could be stopped, though she was immediately thrown into the wind. The man was saved, and the vessel again on her course in about twenty minutes. The second time, the man went over in the middle watch, the studding sails being all set; but the same boat was instantly lowered, and the man easily saved, without it being necessary to rip the ship into the wind and carry the booms away. Now mark a reverse case. A few months ago, a man, well known to the writer, fell overboard in the Channel from a cargo steamer belonging to one of the best firms. It was fine, quiet weather, but he was over twenty minutes in the water before the boat reached him; and had he not been a first-rate swimmer, would of course have been drowned. The writer himself has seen a man overboard from a steamer and swimming nearly half an hour before he was picked up. So many self-disengaging hooks, gripes, and chocks are in the market that there is no reason why at least one boat should not be well fitted in every vessel. One of the best of all these patents (though *not* suitable for *heavy* boats) is the old and well-tried Clifford patent, which has been almost entirely shelved by the numerous disengaging hooks invented in late years, some of which are good, others inferior.

When boats are swung inboard, and resting on chocks, the chocks are to be so constructed that the boat can be at once swung outboard

*without requiring to be lifted by the tackles, i.e.*, it should not be necessary to do more than take the weight off the boat. (See Board of Trade Regulations as to Survey of Steam Ships.)

Masters of deeply loading cargo steamers will say it is impossible to keep a boat swung out. This is only true in heavy weather, and in such times boats should *not* be kept swung out; but the writer can testify thus far, that for some years commanding a deeply loading steamer in the coasting trade from Liverpool, he always kept a light boat fitted with disengaging hooks, and *swung out*, and it was not more than two or three times in a year that it was necessary to swing her in. The vessel was running at a freeboard of about 5 feet (she was flush decked), and the boat, when in the davits, was some 5 feet more above this, or 10 feet from the water. But this boat was carried well aft, and not on the bridge; and if boats were carried here in deep loading steamers they would not be so often washed out of the chocks as they are when carried amidships, where the heavy water is usually shipped.*

Boat sailing is seldom elevated into a science in the Merchant Service, and (unless a boat is smartly rigged with some care) a single lug is the best. The accompanying sketch gives perhaps the best and simplest rigs for boats. Such rigs as these could be very easily fitted at sea out of an old sail past service, if nothing better can be obtained, and a ricker large enough for a mast will not be a ruinous expense. As an example of a fair size for a lug, the following may be of use:—Boat 18 feet long; step the mast about 6 feet from the bow; the mast, from level of gunwale to sheave hole, 12 ft. 6 in.; head of sail, 8 ft.; foot,

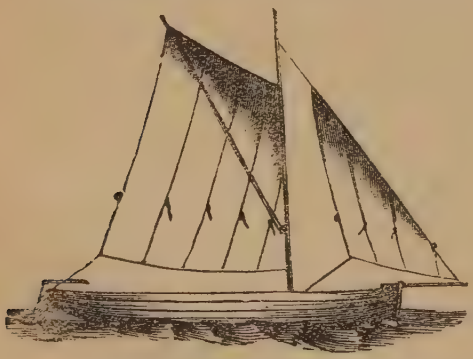
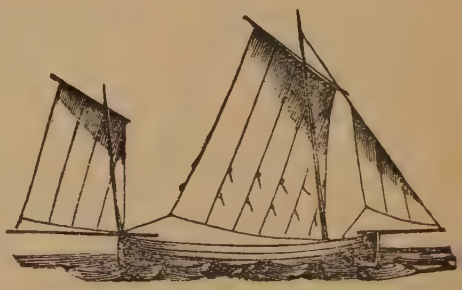


*Plate No. 109.*—Spritsail and jib.



Standing lug, jib, and mizzen.

* A boat lifted in the davits is higher above water level than when lying in the chocks, and there seems no reason why, if securely griped, she should not be as safe in such a position except in very heavy weather. A boat will not escape being stove, by lying in the chocks, if a sea strikes her.

12 feet; after leach, 12 ft.; luff, 9 ft. 22 yards of canvas will make this, and it will be *full* large for the boat. Two reefs should be put in it, the second of which should be half way up the luff.

The rule for determining a boat's carrying capacity is as follows:— Measure the length and breadth outside, and the depth inside, multiply them together. Then multiply the result by decimal six (·6). The product is the capacity of a boat in cubic feet. A lifeboat should be able to carry one adult for every ten cubic feet.

In lowering a boat from a foundering vessel, a lee boat will of course be used, if possible; but in any case use a liberal amount of oil on the sea first, and take a can in the boat if possible. Take also a couple of buckets, as, if the sea is very heavy, they will make a capital drag if obliged to lie head on. It is much better to lie-to than to try to run a boat, and perhaps get swamped. A good drag can be made of the oars and mast lashed together, only in such a case be very careful that they are securely lashed, as the loss of an oar would be a serious matter.

There is generally far more danger in running for the beach before a broken sea than when going against it on starting from the shore. The danger consists in the liability of a boat to broach-to and upset, either by running her bow under water, or by being thrown on her beam ends and overturned broadside on.

In getting *from* shore in a heavy gale and sea, as much way as possible must be got on the boat against an approaching breaking sea, the only chance being to pass end on, through the broken crest, and leave it astern as quickly as possible.

The rules laid down by the Lifeboat Institution are as follows:—

1. *If sufficient command* can be kept over a boat, by the skill of the crew, avoid or dodge the sea, if possible, so as not to meet it at the moment of its breaking or curling over.

2. Against a gale and heavy surf right ahead, get all possible speed on the boat on the approach of every sea that cannot be avoided.

3. If *more speed can be given* to the boat than is sufficient to prevent her being carried back by the surf, her way may be checked on its approach, which will give her an easier passage over it.

On running for the shore *before* a breaking sea, the one great danger is that of broaching-to. The first effect of a roller on overtaking a boat in this position is to throw up her stern and depress the bow. It will sometimes happen that the bow will be driven under water, when the boat will be thrown "end over end;" or if the bow be high, the boat's head may get a cant, and she may in a moment be turned broadside on and swamped.

The rules for managing in such cases are :—

1. Avoid each breaking sea as far as possible by placing the boat where the sea will break ahead of her.

2. If the sea be very heavy, the boat small, and especially if she has a square stern, bring her bow to seaward and *back her in,* rowing ahead against each heavy surf sufficiently to allow it to pass the boat.

3. If it be considered safe to make for shore, bow first, *back the oars* against each sea on its approach, so as to stop the boat's way through the water as much as possible; if there is a drogue, or any means of making one (a bucket for instance) in the boat, tow it astern to assist in keeping the boat end on to the sea, which is *the chief thing to be aimed at.*

4. Bring the principal weights in the boat towards the end which is to seaward, but not the extreme end.

5. Down mast and sails before entering broken water, and take her to land under oars only.

The foregoing directions apply to a flat shore where broken water extends far out. On a steep beach, where the worst broken water is on the beach itself, the procedure will be different.

When running for such a beach the heavy surf will only be reached *when actually on the shore.* The general practice in this case is to keep speed on the boat right on to the beach, and in the act of landing to turn the boat's bow broadside on to the surf; she will then be thrown on her broadside up the beach, where help will usually be at hand to haul her quickly up out of reach of the sea.

From seaward a surf will never appear so bad as it really is, and in making for shore great caution should be used; and, if possible, it will be wise to row along *outside* the broken water till abreast of a coast-guard station or fishing village, where the people ashore can signal the best place to land.

A large canvas bag, the shape of a log bag, three feet in length and two feet diameter, with an iron ring in its mouth, makes a capital drogue to ride a lifeboat; when not in use it lies snugly in the bottom of the boat, and if accidentally trodden upon receives no injury, and is always ready for action at a moment's notice. All lifeboats' painters should be 20 fathoms in length, so that they may be long enough to serve as a sea-anchor cable. When riding a boat by a drogue, have an oil bag fast to the drogue: this will smooth the sea immensely as it approaches the boat. A boat so handled with a drogue and oil bag ought to live out almost any ordinary storm with a very heavy sea.

When putting a boat out in a heavy seaway, keep your vessel dead

before the wind, and take all the way off her you can; then quarter the sea a little, and lower away the boat on the lee quarter. A ship before the sea rolls easy, and the boat stands less chance of being thrown heavily against the side in lowering her down. If you bow the sea the ship will roll violently, and ten chances to one the boat will get stove if she happens to make one of these violent rolls whilst you are lowering the boat down. When lowering boats in stormy weather off the mouths of the Tyne and Wear out of tug steamers, the boats are always lowered with the tug lying stopped before the sea, and it is found both in hoisting the boat up and lowering her down that *before the sea* is the best and most practical method of lowering boats with safety.

Large fenders made of coil with double lanyards should be fitted to each lifeboat, so that one lanyard can be taken under the keel and made fast: this prevents the fender jumping out whilst lowering the boat. These lowering fenders should always be made fast to the inner side of the lifeboat, and kept there at sea. Good large fenders thus made and fitted would save many a lifeboat from getting stove in heavy weather.

Many coasting steamers carry their working boat on the hatch; unfortunately she is then turned bottom up to keep the sea from hurting her. This is a bad practice, and should be universally condemned. If you carry your working boat on the hatch, have two temporary chocks fitted for her so that she is keel down, and have the davit tackles hooked on; if the boat is kept thus she is ready for putting out at a moment's notice. If a fog prevails, swing her out into the davits, or on a dark night in amongst heavy traffic do the same, or in fact at any time when possible. If you are in ballast, and high out of the water, the working boat should always be swung out in the davits, and griped to a spar.

## BOAT'S STORM ANCHOR.

This Storm Anchor for Boats, invented by an old shipmate, is to be had of E. M. Crawford, 34 Bold Street, Liverpool. As will be seen by the illustrations, this "Storm Anchor" is like an umbrella in its general features.

*Plate No. 110.*

When closed, as above, it measures about three feet in length, and

eight or ten inches in circumference. It can be strapped under a seat in the boat, and the seat marked "Storm Anchor." In this position it is safe and handy for instant use. It has a case attached to preserve it from any ill effects of weather and atmosphere while stowed away, —this is as easily unloosed as the band of an umbrella. To launch the anchor, bend on the boat's painter to the "grommet" affixed to the handle, and drop the apparatus overboard. As soon as it touches the water it opens naturally, and the strain upon the rope quickly brings the boat's head to sea.

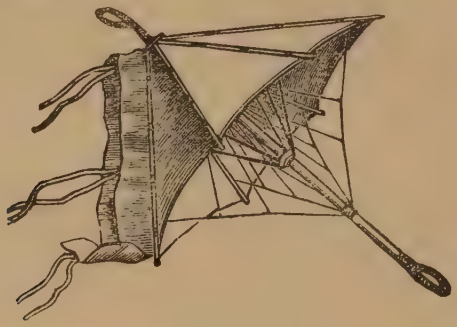


*Plate No. 111.*

The above diagram shows the anchor open. To the "stick" are six strong cane ribs, covered on the inside with sail-cloth. The stretchers between the ribs and the runners on the stick allow the anchor to open immediately a strain is put upon the painter to which the boat is drifting. There is a check on the stick to prevent the apparatus opening beyond its conical shape. The chords shown in the sketch are so arranged that they cannot become entangled. The "grommet" at the top of the stick is to make fast a line, for capsizing the anchor, and hauling it on board when no longer of service.

## SECTION XXIX*A*.

# LIFE-SAVING APPLIANCES.

RULES MADE BY THE BOARD OF TRADE UNDER SECTION 427 OF THE MERCHANT SHIPPING ACT, 1894.

At the Council Chamber, Whitehall. This 8th day of May, 1914.

PRESENT:

The Right Honourable John Burns, M.P.

In pursuance of the provisions of Section 427 of the Merchant Shipping Act, 1894, the Board of Trade do hereby make the following Rules relating to life-saving appliances, in substitution for the Rules dated the 17th January, 1913; and do hereby direct that these Rules shall come into operation on the 1st day of July, 1914.

(Signed) JOHN BURNS.

## FOREIGN-GOING.

### CLASS 1.

*Rules for foreign-going passenger steamers, including emigrant ships.*

*Rule A.*—(1) A ship of this class shall carry lifeboats in such number and of such aggregate capacity as shall be sufficient to accommodate the total number of persons which is carried, or which the ship is certified to carry, whichever number is the greater.

Provided that if the aggregate capacity of the lifeboats carried by a ship of this class exceeds the capacity required by General Rule 2, the Board of Trade may allow one or more life-rafts conforming to the conditions laid down in that Rule to be carried in lieu of any of the remaining lifeboats which would otherwise be required by the present Rule.

(2) The master or owner of a ship of this class claiming to carry on any voyage fewer lifeboats and life-rafts than will provide sufficient accommodation for all the persons for which the ship is certified, must declare before the Collector or other Officer of Customs, before the time of clearance, that the lifeboats and life-rafts actually carried will be sufficient to accommodate all persons who will be carried at any time during the voyage to foreign ports and the voyage back to the United Kingdom.

*Rule B.*—A ship of this class shall, subject to the provisions of General Rule 20 (1), be provided, in accordance with its length, with the number of sets of davits specified in Column A of the Table in Appendix I.

Provided that no ship shall be required to have a number of sets of davits greater than the number of boats required to accommodate the total number of persons which is carried, or which the ship is certified to carry, whichever number is the greater, and provided further that the Board of Trade may, where it appears to them necessary, having regard to the height at which the boats are carried above the centre of the load line disc, and to the other circumstances of the case, require a ship of this class to carry in lieu of, or in addition to, davits, some other approved form of launching appliances, or such arrangements for launching boats as may be, in their opinion, effective.

*Rule C.*—(1) Each set of davits shall have a lifeboat of Class 1 attached to it, and of these lifeboats at least the minimum number specified in Column B of the Table in Appendix I. shall be open boats.

(2) Any additional lifeboats which may be required to make up the total lifeboat accommodation, may be boats of Class 1 or Class 2.

*Rule D.*—If the ship is under 400 feet in length, at least twelve approved lifebuoys shall be carried; if 400 feet or over, but under 600 feet, at least eighteen approved lifebuoys shall be carried; if 600 feet or over, but under 800 feet, at least twenty-four approved lifebuoys shall be carried; and if 800 feet or over, at least thirty approved lifebuoys shall be carried.

*Rule E.*—One approved life-jacket shall be carried for each person on board, and in addition a sufficient number of approved life-jackets of a size suitable for children.

*Rule F.*—The Board of Trade may schedule certain voyages between specified ports or places outside the United Kingdom as being, for the purpose of these Rules, voyages of a nature similar to one or other of the classes of voyages within Home Trade limits provided for in the Rules.

If a foreign-going passenger steamer is permitted by the terms of the passenger certificate to carry, between specified ports or places abroad, a number of passengers in addition to the number allowed when the ship is proceeding to sea from the United Kingdom, and such a voyage has been scheduled in accordance with the provisions of this Rule, that ship shall, so far as concerns the additional passengers carried between those ports or places, comply with the Rules applicable to the class of Home Trade voyage to which the voyage has been scheduled as similar.

### Class II.

*Rules for foreign-going steamships not certified to carry passengers.*

*Rule A.*—A ship of this class shall carry on each side of the ship lifeboats of Class 1 in such number and of such aggregate capacity as will accommodate all persons on board; Provided that if the total number of lifeboats required under this Rule exceeds two, a boat of Class 3 may be carried in lieu of one of them; and if the number exceeds three, one or two boats of Class 3 may be carried in lieu of the same number of lifeboats.

*Rule B.*—The lifeboats, and boats of Class 3 carried in lieu of lifeboats, shall be attached to davits.

*Rule C.*—At least six approved lifebuoys shall be carried, together with one approved life-jacket for each person on board.

### Class III.

*Rules for foreign-going sailing ships carrying more than twelve passengers.*

*Rule A.*—A ship of this class shall carry lifeboats in such number and of such aggregate capacity as shall be sufficient to accommodate all persons on board.

*Rule B.*—All the lifeboats shall be attached to davits as far as practicable in the opinion of a Board of Trade Surveyor.

*Rule C.*—At least six approved lifebuoys shall be carried, together with one approved life-jacket for each person on board, and, in addition, a sufficient number of approved life-jackets of a size suitable for children.

### Class IV.

*Rules for foreign-going sailing ships not carrying more than twelve passengers.*

*Rule A.*—A ship of this class shall carry a lifeboat or lifeboats of Class 1 of such capacity as shall be sufficient to accommodate all persons on board; if only one lifeboat is required under this Rule, a boat of Class 3 shall be carried in addition, and if the number of lifeboats required under this Rule exceeds two, a boat of Class 3 may be carried in lieu of one of them.

*Rule B.*—Two boats at least shall be attached to davits, one on each side of the ship.

*Rule C.*—At least four approved lifebuoys shall be carried, together with one approved life-jacket for each person on board.

## HOME TRADE.

### Class I.

*Rules for steamships certified to carry passengers anywhere within Home Trade limits*, i.e., *between places in the British Islands (that is to say, the United Kingdom, the Channel Islands, and the Isle of Man), or between the British Islands and the Continent of Europe between the River Elbe and Brest inclusive.*

*Rule A.*—A ship of this class shall, subject to the provisions of General Rule 20 (1), be provided in accordance with its length with the number of sets of davits specified in Column A of the Table in Appendix I.; each set of davits shall have a lifeboat attached to it.

Provided that no ship shall be required to have a number of sets of davits greater than the number of boats required to accommodate the total number of persons carried, or which the ship is certified to carry, whichever number is the greater.

The lifeboats attached to davits may be either open or pontoon lifeboats, but no ship shall carry attached to davits a number of open lifeboats less than that specified in accordance with its length in Column B of the Table in Appendix I.

*Rule B.*—In a ship of this class launched on or after the 1st March, 1913, if the lifeboats attached to davits do not provide the aggregate capacity specified in the Table in Appendix II., additional lifeboats shall be carried to make up that capacity.

Provided that no ship at whatever date launched shall be required to carry lifeboats of an aggregate capacity greater than is required to accommodate the total number of persons carried.

*Rule C.*—Subject to the provisions of General Rule 20 (3), if the lifeboats carried do not provide sufficient accommodation for the total number of persons which the ship is allowed by her ordinary passenger certificate to carry, approved life-rafts, approved buoyant deck seats, or other approved buoyant apparatus shall be carried so that they, together with the lifeboats, shall provide sufficient accommodation for the total number of persons for which the ship is so certified.

*Rule D.*—Where a ship of this class has a special passenger steamer's certificate allowing her, when engaged upon daylight voyages between the 20th March and the 30th September, inclusive, to carry a number of persons in excess of the total number of persons allowed by her ordinary passenger certificate, the lifeboats, approved life-rafts, approved buoyant deck seats, or other approved buoyant apparatus carried shall provide sufficient accommodation for 80 per cent. of the number allowed by such special passenger steamer's certificate, or for the total number of persons allowed by the ordinary passenger steamer's certificate, whichever number is the greater.

*Rule E.*—At least ten approved lifebuoys shall be carried, together with one approved life-jacket for each person on board, and in addition, a sufficient number of approved life-jackets of a size suitable for children.

### Class II.

*Rules for steamships trading within home trade limits, but not certified to carry passengers.*

*Rule A.*—A ship of this class if 100 feet or over in length shall carry a boat or boats on each side of the ship of such capacity as shall be sufficient to accommodate all persons on board. The boats shall be attached to davits.

*Rule B.*—One of the boats may be a boat of Class 3. The remaining boats shall be lifeboats of Class I.

*Rule C.*—A ship of this class if under 100 feet in length shall carry at least one open boat of Class 1, so stowed that it can be readily placed in the water no either side of the ship, and of sufficient capacity to accommodate all the persons on board.

*Rule D.*—A ship of this class if 100 feet or over in length shall carry at least four approved lifebuoys, and if under 100 feet at least two approved lifebuoys. One approved life-jacket shall be carried for each person on board.

### Class III.

*Rules for sailing ships carrying passengers anywhere within home trade limits.*

*Rule A.*—A ship of this class shall carry a lifeboat or lifeboats of sufficient aggregate capacity to accommodate all persons on board.

*Rule B.*—The lifeboats shall, as far as practicable, be attached to davits.

*Rule C.*—At least four approved lifebuoys shall be carried, together with one approved life-jacket for each person on board, and in addition a sufficient number of approved life-jackets suitable for children.

### Class IV.

*Rules for sailing ships trading within home trade limits but not carrying passengers.*

*Rule A.*—Subject to the provisions of Rule B, a ship of this class shall carry a boat or boats of such capacity as shall be sufficient to accommodate all persons on board. The boats shall be stowed in such a manner that they can readily be placed in the water on either side of the ship. At least one of the boats shall be an open boat of Class 1.

*Rule B.*—A ship of this class if under 100 feet in length and engaged solely in the coasting trade shall comply with the requirements of Rule A, except that the boat or boats carried may be of Class 3.

*Rule C.*—A ship of this class if 100 feet or over in length shall carry at least four approved lifebuoys, and if under 100 feet at least two approved lifebuoys. One approved life-jacket shall be carried for each person on board.

## GENERAL RULES.

### 1. *Interpretation.*

(1) In these Rules, unless the context otherwise requires:—

"*Person*" means a person over the age of one year.

"*Passenger*" has the same meaning as in Section 267 of the Merchant Shipping Act, 1894.

"*Passenger steamer*" means a steamer which carries more than twelve passengers.

"*Emigrant ship*" has the same meaning as in Section 268 of the Merchant Shipping Act, 1894, as amended by Section 14 of the Merchant Shipping Act, 1906.

"*Daylight*" shall be reckoned as extending from one hour before sunrise to one hour after sunset.

"*Approved*" means approved by the Board of Trade.

"*Length*," where a ship is referred to, means registered length.

(2) The Interpretation Act, 1889, shall apply to these Rules in the same way as it applies to an Act of Parliament.

2. *Power of the Board of Trade to accept alternatives.*

The Board of Trade shall have power, in general or in any particular case, to accept any boat, raft, buoyant apparatus, or other life-saving appliance, in lieu of a life-saving appliance required by these Rules, subject to such conditions as they may impose, if they are satisfied that under those conditions it will be as effective as the appliance required by these Rules.

Provided that in the case of a foreign-going passenger steamer no life-saving appliance shall be accepted in lieu of a lifeboat required by these Rules, except either some other approved type of lifeboat or a life-raft approved as being in every respect as efficient as the pontoon life-raft described in General Rule 10.

Provided also that no life-raft shall be accepted on a foreign going passenger steamer in lieu of a lifeboat required by these Rules unless the total cubic capacity of the lifeboats provided is at least equal to the greater of the two following amounts:—

(i.) 75 per cent of the total capacity required to accommodate all the persons carried.

or (ii.) The minimum capacity required by Column C of the Table in Appendix I.

3. *Boats.*

For the purposes of these Rules boats are arranged in the following classes:—

CLASS I.

A. *Open lifeboats with internal buoyancy only.*

The buoyancy of a wooden boat of this type shall be provided by water-tight air-cases, the total volume of which shall be at least equal to one-tenth of the cubic capacity of the boat.

In the case of a metal boat an addition shall be made to the cubic capacity of the airtight compartments, so as to give it buoyancy equal to that of the wooden boat.

B. *Open lifeboats with internal and external buoyancy.*

The internal buoyancy of a wooden boat of this type shall be provided by water-tight air-cases, the total volume of which shall be at least equal to seven and a half per cent. of the cubic capacity of the boat.

If the external buoyancy is of cork, its volume, for a wooden boat, shall not be less than thirty-three thousandths of the cubic capacity of the boat; if of any material other than cork, its volume and distribution shall be such that the buoyancy and stability of the boat are not less than that of a similar boat provided with external buoyancy of cork.

In the case of a metal boat an addition shall be made to the cubic capacity of the airtight compartments, so as to give it buoyancy equal to that of the wooden boat.

C. *Pontoon lifeboats having a well deck and fixed water-tight bulwarks.*

The area of the well deck of a boat of this type shall be at least thirty per cent. of the total deck area. The height of the well deck above the water line at all points shall be at least equal to one-half per cent. of the length of the boat, this height rising to one and a half per cent. of the length of the boat at the ends of the well.

The freeboard of a boat of this type shall be such as to provide for a reserve buoyancy of at least thirty-five per cent.

CLASS 2.

A. *Open lifeboats having the upper part of the sides collapsible.*

A boat of this type shall be fitted both with watertight air-cases and with external buoyancy, the volume of which, for each person which the boat is able to accommodate, shall be at least equal to the following amounts :—

| | Cubic feet. |
|---|---|
| Air cases ... ... ... ... ... ... | 1·5 |
| External buoyancy (if of cork) ... ... ... | 0·2 |

The minimum freeboard of boats of this type is fixed in relation to their length ; it shall be measured vertically to the top of the solid hull at the side amidships, from the water-level when the boat is loaded.

The freeboard in fresh water shall not be less than the following amounts :—

| Length of the Boat in feet. | Minimum Freeboard in inches. |
|---|---|
| 26 | 8 |
| 28 | 9 |
| 30 | 10 |

The freeboard of boats of intermediate lengths shall be found by interpolation.

B. *Pontoon lifeboats having a well deck and collapsible bulwarks.*

All the conditions laid down for boats of Class 1 C shall be applied to boats of this type, which differ from those of Class 1 C only in regard to the bulwarks.

C. *Pontoon lifeboats having a flush deck and collapsible bulwarks.*

The minimum freeboard of boats of this type is independent of their length and depends only upon their depth. The depth of the boat shall be measured vertically from the underside of the garboard strake to the top of the deck at the side amidships and the freeboard shall be measured from the top of the deck at the side amidships to the water level when the boat is loaded.

The freeboard in fresh water shall not be less than the following amounts, which are applicable without correction to boats having a mean sheer equal to three per cent. of their length :—

| Depth of Boat in inches. | Minimum Freeboard in inches. |
|---|---|
| 12 | $2\frac{3}{4}$ |
| 18 | $3\frac{3}{4}$ |
| 24 | $5\frac{1}{8}$ |
| 30 | $6\frac{1}{2}$ |

For intermediate depths the freeboard shall be obtained by interpolation.

If the sheer is less than the standard sheer defined above, the minimum freeboard shall be obtained by adding to the figures in the table one-seventh of the difference between the standard sheer and the actual mean sheer measured at the stem and stern post ; no deduction shall be made from the freeboard on account of the sheer being greater than the standard sheer or on account of the camber of the deck.

CLASS 3.

Open boats which have not the buoyancy required for lifeboats of Class I.

4 *Motor Boats.*

(1) An approved motor boat may be carried as a lifeboat subject to the following conditions :—

(*a*) It shall comply with the requirements for a lifeboat of Class 1, and proper appliances shall be provided for putting it into the water speedily.

(*b*) It shall be adequately provided with fuel, and kept so as to be at all times fit and ready for use.

(2) Where the number of lifeboats is less than ten, one of them may be a motor boat. Where the number of lifeboats is not less than ten, two of them may be motor boats. The Board of Trade may, on the application of an owner, allow a greater number of motor boats to be carried, if they are satisfied that the efficiency of the life-saving equipment will not thereby be diminished.

(3) In fixing the volume of the internal buoyancy and, where fitted, the external buoyancy, regard shall be had to the difference between the weight of the motor and its accessories and the weight of the additional persons which the boat could accommodate if the motor and its accessories were removed.

5 *Construction of Boats.*

(1) All boats shall be properly constructed, and shall be of such form and proportions that they shall have ample stability in a seaway, and sufficient freeboard when loaded with their full complement of persons and equipment. They shall be fitted and arranged to the satisfaction of the Board of Trade.

(2) The structural strength of the boats shall be to the satisfaction of the Board of Trade, and in the case of foreign-going passenger steamers launched on or after the 1st March, 1913, sufficient to permit of the boats being safely lowered into the water with the full complement of persons and equipment on board.

(3) In all open boats, all thwart and side seats shall be fitted as low in the boat as practicable, and shall provide seating accommodation for all persons the boat is deemed fit to carry, and bottom boards shall be fitted so that the thwarts shall not be more than 2 feet 9 inches above them.

(4) Internal buoyancy apparatus shall be constructed of copper or yellow metal of not less than 18 ozs. to the superficial foot, or of other durable material, and in open boats of Class 1 may be placed along the sides or at the ends of the boat, but not in the bottom of the boat. External buoyancy apparatus may be of cork or of any other equally efficient approved material; the use of rushes, cork shavings, loose granulated cork, or any other loose granulated substance, and the use of apparatus dependent upon inflation by air, is prohibited.

(5) Open lifeboats of Class 1 shall have a mean sheer at least equal to four per cent. of their length.

(6) Pontoon lifeboats may be built of wood or metal. If constructed of wood, they shall have the bottom and deck made of two thicknesses with textile material between; if of metal, they shall be divided into watertight compartments with means of access to each compartment and shall be provided with at least two bilge pumps.

(7) All pontoon lifeboats shall be fitted with efficient means for quickly clearing the deck of water. The orifices for this purpose shall be such that the water cannot enter the boat through them when they are intermittently submerged. The number and size of the orifices shall be determined by the Board of Trade for each type of boat by special test.

For the purpose of this test:—

(*a*) The pontoon boat shall be loaded with a weight of iron equal to that of its complement of persons and equipment;

(*b*) In the case of a boat 28 feet in length, two tons of water shall be cleared from the boat in a time not exceeding the following:—

| | | |
|---|---|---|
| Class 1C | ... ... ... ... ... | 60 seconds. |
| „ 2B | ... ... ... ... ... | 60 „ |
| „ 2C | ... ... ... ... ... | 20 „ |

In the case of a boat having a length greater or less than 28 feet the weight of water to be cleared in the same time shall be for each type directly proportional to the length of the boat.

(8) No boat shall be accepted as a lifeboat the buoyancy of which depends upon the previous adjustment of one of the principal parts of the hull.

(9) All boats shall be fitted for the use of a steering oar.

(10) All boats shall be permanently marked to the satisfaction of the Board of Trade in such a way as to indicate plainly their dimensions and the number of persons for which they are approved. Boats that have been properly marked need not be re-measured, unless there is reason to believe that the marks have been tampered with or are otherwise defective or improper.

*Number of Persons.*

(1) The number of persons which a lifeboat shall be deemed fit to carry shall be equal to the greatest whole number obtained by dividing the capacity of the boat in cubic feet, or the surface of the boat in square feet, as the case may be (calculated as provided by General Rules 7 and 8), by the standard unit of capacity, or unit of surface, defined below.

(2) The cubic capacity in feet of a boat in which the number of persons is determined by the surface shall be assumed to be ten times the number of persons which the boat is authorised to carry

(3) The standard units of capacity and surface are as follows :—

| Unit of Capacity. | Cubic Feet. |
|---|---|
| Class 1A. | 10 |
| Class 1B. | 9 |
| Class 3 | 10 |

| Unit of Surface. | Square Feet. |
|---|---|
| Class 2A. | $3\frac{1}{2}$ |
| Class 2C. | |
| Class 1C. | $3\frac{1}{4}$ |
| Class 2B. | |

(4) The Board of Trade may accept a smaller divisor for pontoon boats of Class 1C and Class 2B, if they are satisfied after trial that the number of persons for whom there is seating accommodation in the boat in question is greater than the number obtained by applying the above divisor, provided always that the divisor adopted in place of $3\frac{1}{4}$ shall never be less than 3.

(5) The number of persons obtained by the above rules shall be reduced :—

(i) If it is greater than the number of persons for which there is proper seating accommodation, the latter number being determined in such a way that the persons when seated do not interfere in any way with the use of the oars, or

(ii) If, in the case of boats other than open boats of Class 1, the freeboard when the boat is fully loaded is less than the freeboard required by these Rules.

(6) If a Surveyor is doubtful as to the number of persons any boat is fit to carry he may require the boat to be tested afloat with the intended number of persons on board.

(7) The Board of Trade may limit the number of persons to be allowed in boats with very fine ends and in boats very full in form.

(8) Two children under the age of twelve years may be carried in place of one adult person.

7. *Cubic capacity of Open Boats of Class* 1.

(1) In the case of an open boat of Class 1 the cubic capacity shall be determined by the following formula :—

$$\text{Capacity} = \frac{l}{12}(4A + 2B + 4C)$$

$l$ denotes the *length* of the boat in feet from the inside of the planking or plating at the stem to the corresponding point at the stern post ; in the case of a boat with a square stern the length is measured to the inside of the transom.

$A$, $B$, $C$ denote respectively the *areas of the cross-sections* at the quarter length forward, amidships, and the quarter length aft, which correspond to the three points obtained by dividing $l$ into four equal parts (the areas corresponding to the two ends of the boat are considered negligible).

The areas $A$, $B$, $C$ shall be deemed to be given in square feet by the successive application of the following formula to each of the three cross-sections :—

$$\text{Area} = \frac{h}{12}(a + 4b + 2c + 4d + e).$$

$h$ denotes the *depth* measured in feet inside the planking or plating from the keel to the level of gunwale, or, in certain cases, to a lower level, as determined hereafter.

$a$, $b$, $c$, $d$, $e$ denote the horizontal *breadths* of the boat measured in feet to the inside of the planking at the upper and lower points of the depth and at the three points obtained by dividing $h$ into four equal parts ($a$ and $e$ being the breadths at the extreme points, and $c$ at the middle point, of $h$).

(2) If the sheer of the gunwale, measured at the two points situated at a quarter of the length of the boat from the ends, exceeds 1 per cent. of the length of the boat, the depth employed in calculating the area of the cross-sections $A$ or $C$ shall be deemed to be the depth amidships plus 1 per cent. of the length of the boat.

(3) If the depth of the boat amidships exceeds 45 per cent. of the breadth, the depth employed in calculating the area of the midship cross-section $B$ shall be deemed to be equal to 45 per cent. of the breadth, and the depth employed in calculating the areas of the quarter length sections $A$ and $C$ shall be obtained by increasing this last figure by an amount equal to 1 per cent. of the length of the boat, provided that in no case shall the depths employed in the calculation exceed the actual depths at these points.

(4) If the depth of the boat is greater than 4 feet the number of persons given by the application of these General Rules shall be reduced in proportion to the ratio of 4 feet to the actual depth, until the boat has been tested afloat with that number of persons on board all wearing life-jackets, and the test has proved satisfactory.

(5) The cubic capacity of a boat may be assumed to be the product of the length, the breadth and the depth multiplied by 0·6 in cases where it is clear that this formula, does not give a greater capacity than that obtained by the above method. The dimensions shall then be measured in the following manner :—

*Length :* From the intersection of the outside of the planking with the stem to the corresponding point at the stern post or, in the case of a square sterned boat, to the after side of the transom.

*Breadth:* From the outside of the planking at the point where the breadth of the boat is greatest.

*Depth:* Amidships inside the planking from the keel to the level of the gunwale, but the depth used in calculating the cubic capacity may not in any case exceed 45 per cent. of the breadth.

In all cases the shipowner shall have the right to require that the cubic capacity of the boat shall be determined by exact measurement.

(6) If the oars are pulled in rowlocks, the bottom of the rowlock shall be considered as the gunwale in measuring the depth of the boat.

(7) The cubic capacity of a motor-boat shall be obtained from the gross capacity by deducting a volume equal to that occupied by the motor and its accessories.

8. *Deck area and capacity of Pontoon Boats and of Open Boats of Class* 2.

In the case of boats of the above types the surface in square feet shall be determined by the following formula:—

$$\text{Area} = \frac{l}{12}(2a + 1{\cdot}5b + 4c + 1{\cdot}5d + 2e).$$

$l$ denotes the *length* in feet from the intersection of the outside of the planking with the stem to the corresponding point at the stern post.

$a$, $b$, $c$, $d$, $e$ denote the *horizontal breadths* in feet outside the planking at the points obtained by dividing $l$ into four equal parts and sub-dividing the foremost and aftermost parts into two equal parts ($a$ and $e$ being the breadths at the extreme sub-divisions, $c$ at the middle point of the length, and $b$ and $d$ at the intermidiate points).

9. *Size of boats.*

No boat carried in compliance with these Rules shall have a capacity of less than 125 cubic feet.

10. *Life-Rafts.*

(1) An approved pontoon life-raft shall satisfy the following conditions:—

(i.) It shall be reversible and fitted with bulwarks of wood, canvas or other suitable material on both sides. These bulwarks may be collapsible.

(ii.) It shall be of such size, strength and weight that it can be handled without mechanical appliances, and, if necessary, be thrown from the vessel's deck.

(iii.) It shall have not less than three cubic feet of air-cases or equivalent buoyancy for each person whom it can accommodate.

(iv.) It shall have a deck area of not less than four square feet for each person whom it can accommodate and the platform shall not be less than six inches above the water level when the raft is loaded.

(v.) The air cases or equivalent buoyancy should be placed as near as possible to the sides of the raft.

(2) Every raft shall be marked to the satisfaction of the Board of Trade in such a way as plainly to indicate the number of persons for which it is approved.

(3) Two children under the age of twelve years may be carried in place of one adult person.

(4) In ships which carry rafts there shall be a sufficient number of rope ladders, or other approved appliances, always available for use in embarking the persons in the rafts.

11. *Weight of Persons.*

In the tests prescribed by these Rules for determining the number of persons which a boat or pontoon raft can accommodate each person shall be assumed to be an adult person wearing a life-jacket.

In verifications of freeboard the pontoon boats shall be loaded with a weight of at least 165 lbs. for each adult person that the pontoon boat is authorised to carry.

12. *Stowage of Boats, Rafts, etc.*

(1) All boats and rafts shall be stowed in such a way that—

(*a*) They can be launched in the shortest possibe time;

(*b*) Even under conditions of list and trim unfavourable from the point of view of the handling of the boats and rafts as large a number of persons as possible can be embarked in them;

(*c*) As large a number of the boats and rafts as possible shall be capable of being launched on either side of the ship, either by means of approved appliances for transferring them from one side of the deck to the other, or by stowing some of the additional boats or rafts in rows across the deck, or by some other equally satisfactory means.

(2) With regard to the stowage of additional lifeboats and rafts, the following provisions shall also apply:—

(*a*) Additional lifeboats may be stowed under lifeboats of Class I. attached to davits;

(*b*) Additional lifeboats may be stowed in tiers of two or three one above another, or they may, subject to such conditions as the Board of Trade may impose, be fitted one within another;

(*c*) Additional lifeboats, and rafts, may be stowed in rows across a deck bridge or poop;

(*d*) Means shall be provided to the satisfaction of the Board of Trade for attaching additional lifeboats to the davits, and lowering them into the water, in the shortest possible time, and in the case of boats not stowed under davits for securing their transfer to the ship's side in the shortest possible time.

(3) Where a boat is stowed underneath another boat there shall be provided approved removable supports or other approved appliances, so as to secure that the weight of a boat is not unduly supported by the boat underneath it.

(4) Boats may only be stored on more than one deck on condition that proper measures are taken to prevent the boats from a lower deck being fouled by those from a deck above.

(5) All other buoyant apparatus, lifebuoys and life-jackets shall be so stowed as to be readily available in case of emergency.

13. *Appliances for lowering boats.*

(1) The davits shall be of approved form and shall be suitably placed to the satisfaction of the Board of Trade. They shall be fitted on one or more of the decks in such positions that the boats can be efficiently lowered from them, and shall be so spaced and placed that the boats can be swung out with facility. Davits shall not be fitted in the bows of a ship, but they may be fitted in any other position in the ship, provided that the boats are not brought into dangerous proximity to a propeller at the time of launching.

(2) The davits, falls, blocks, and all other gear required for lowering the boats, shall be of sufficient strength to the satisfaction of the Board of Trade ; and in the case of foreign-going passenger steamers launched on or after the 1st March, 1913, they shall be of such strength that the boats can be lowered safely with the full complement of persons and equipment, the ship being assumed to have a list of 15 degrees

(3) In the case of foreign-going passenger steamers launched on or after the 1st July, 1914, the davits shall be fitted with a gear of sufficient power to ensure that the boat can be turned out against the maximum list under which the lowering of the boats is possible on the vessel on which they are fitted.

(4) The boat's falls shall be long enough to lower the boat into the water with safety when the vessel is light. Life-lines shall be fitted to the davit spans, and shall be long enough to reach the water when the vessel is light Hooks shall not be attached to the lower tackle blocks.

(5) Means shall be provided for speedily but not necessarily simultaneously or automatically, detaching the boats from the falls , the boats placed under davits shall be attached to the falls and kept ready for service ; the points of attachment of the boats to the falls shall be sufficiently away from the ends of the boats to ensure their being easily swung clear of the davits ; the boats' chocks shall be of such construction and arrangement as shall be satisfactory to the Board of Trade.

(6) Where more boats than one are served by the same set of davits, arrangements shall be made to prevent the falls fouling when they are recovered, and, where more than three boats are served by the same set of davits, there shall be provided an approved appliance for lowering the boats in turn and rapidly.

(7) The Board of Trade may accept in lieu of davits or sets of davits any other appliance, appliances, or arrangements, which appear to them at least as effective as davits for placing the boats in the water.

14. *Equipment for boats and life-rafts.*

(1) Every boat which is carried by any ship shall be equipped as follows —

(*a*) With the full single banked complement of oars and two spare oars, and a steering oar.

(*b*) With two plugs for each plug hole, attached with lanyards or chains and one set and a half of thole pins or crutches, attached to the boat by sound lanyards. Plugs shall not be required where proper automatic valves are fitted.

(*c*) With a sea anchor, a bailer, a galvanised iron bucket, a rudder and a tiller, or yoke and yoke lines, a painter of sufficient length, and a boat-hook. The rudder, the bailer, and the bucket shall be attached to the boat by sufficiently long lanyards, and kept ready for use.

(*d*) With a vessel capable of holding one quart for each person that the boat is deemed fit to carry. This vessel shall be kept filled with fresh water, and provided with a dipper with lanyard.

(*e*) With two hatchets, one to be kept in each end of the boat, and to be attached to the boat by a lanyard.

(*f*) With a line securely becketted round the outside of the boat.

(*g*) With an efficient lantern trimmed, with oil in its receiver sufficient to burn eight hours ; or with some other lantern or light at least as effective approved by the Board of Trade.

(2) In addition to the equipment prescribed above, the boats in all Classes of foreign-going ships shall be equipped as provided in paragraphs (*a*) to (*e*), inclusive, of this sub-section of this Rule. The Board of Trade may, however, exempt from the requirement to carry masts, sails, and compasses a proportion of the boats of ships which carry passengers in the North Atlantic, and which are equipped with wireless telegraphy. The boats of ships in Classes I to V., inclusive, of the Home Trade shall be provided with the additional equipment specified in paragraphs (*b*) (*d*), and (*e*) of this sub-section of this Rule.

(*a*) With a mast or masts, and with at least one good sail and proper gear for each ; but this does not apply to an approved motor boat.

(*b*) With an efficient compass.

(*c*) With an air-tight case containing 2 pounds of biscuits for each person for whom the boat is approved.

(*d*) With one gallon of vegetable or animal oil, and a vessel of approved pattern for distributing it on the water in rough weather. This vessel shall be capable of being attached to the sea anchor

(*e*) With one dozen self-igniting red lights in a water-tight tin, and a box of suitable matches in a water-tight tin.

(3) Every life-raft, which is carried by a foreign-going ship, shall be equipped as follows :--

(*a*) With four oars and five thole pins or crutches attached to the raft by sound lanyards, and a steering oar.

(*b*) With a sea anchor and a painter of sufficient length.

(*c*) With a vessel capable of holding one quart for each person that the raft is deemed fit to carry. This vessel shall be kept filled with fresh water and provided with a dipper with lanyard.

(*d*) With a line securely becketted round the outside of the raft.

(*e*) With a self-igniting lifebuoy light.

(*f*) With one gallon of vegetable or animal oil, and a vessel of approved pattern for distributing it on the water in rough weather. This vessel shall be capable of being attached to the sea anchor.

(*g*) With an air-tight case containing two pounds of biscuits for each person for whom the raft is approved.

(*h*) With one dozen self-igniting red lights in a water-tight tin, and a box of suitable matches in a water-tight tin

(4) Every life-raft which is carried by a Home Trade ship shall be provided with a suitable approved equipment.

(5) All boats and rafts shall be fully equipped before the ship leaves harbour, and the equipment shall remain in the boat or raft throughout the voyage, while the ship is at sea. Such of the articles as are liable to be stolen or mislaid shall be properly secured to the boat or raft. If it is not practicable to place the whole of the equipment in the boat or raft the part not so placed shall be stowed in a suitable locker near by, and each article shall be marked with the number of the boat or raft to which it belongs.

15. *Buoyant Apparatus.*

Approved buoyant apparatus, whether buoyant deck seats, buoyant deck chairs or other buoyant apparatus, shall be deemed sufficient, so far as buoyancy is concerned, for a person or a number of persons to be ascertained by dividing the number of pounds of iron which it is capable of supporting in fresh water by 32. Such

buoyant apparatus shall be of approved material and construction, and if it depends for its buoyancy on air shall not require to be inflated before use, and shall be marked in such a way as plainly to indicate that it is buoyant and the number of persons for which it is approved.

16. *Life-Jackets.*

An approved life-jacket shall mean a jacket of approved material and construction, which is capable of floating in fresh water for 24 hours with 15 lbs. of iron suspended from it, or any other approved appliance of equal buoyancy and capable of being fitted on the body. Life-jackets the buoyancy of which depends on air compartments are prohibited. Life-jackets for children shall be of a suitable size and buoyancy to the satisfaction of the Board of Trade.

17. *Lifebuoys.*

(1) (*a*) An approved lifebuoy shall be of solid cork or other equivalent material. It shall be capable of floating in fresh water for at least 24 hours with 32 lbs. of iron suspended from it.

(*b*) Lifebuoys filled with rushes, cork shavings, granulated cork or any other loose granulated material, or whose buoyancy depends upon air compartments requiring inflation, are prohibited.

(2) All lifebuoys shall be fitted with beckets securely seized, and at least one on each side of the ship shall be fitted with a life-line at least 15 fathoms in length.

(3) (*a*) Self-igniting lifebuoy lights shall be placed near the following number of lifebuoys:—

| | |
|---|---|
| In a ship in Class VI., Home Trade ... | not less than two; |
| In every other ship, except ships in Class VII., VIII., IX., or X., Home Trade ... ... ... ... | at least half the lifebuoys required by these Rules and not less than six in any passenger steamer. |

(*b*) Such lifebuoy lights shall be efficient and inextinguishable in water to the satisfaction of the Board of Trade, and provided with means for attachment to the lifebuoys.

18. *Position of Lifebuoys and Life-jackets.*

All lifebuoys and life-jackets shall be suitably placed to the satisfaction of a Board of Trade Surveyor and so as to be readily accessible to all persons on board; and their position shall be plainly indicated so that it may be known to those for whom they are intended.

Lifebuoys shall always be capable of being rapidly cast loose and shall not be rigidly secured in any way.

## APPENDIX I.

TABLE SHOWING THE MINIMUM NUMBER OF SETS OF DAVITS AND THE MINIMUM NUMBER OF OPEN BOATS REQUIRED TO BE PROVIDED IN A STEAMSHIP IN CLASS I., FOREIGN-GOING, OR IN CLASS I., HOME TRADE, OR IN CLASS V., HOME TRADE (EXCEPT IN CERTAIN CASES), AND THE MINIMUM LIFE-BOAT CAPACITY FOR THE PURPOSES OF GENERAL RULE 2.

| Registered Length of the Ship. | (A.) Minimum number of sets of davits | (B.) Minimum number of open boats, Class I. | (C.) Minimum aggregate cubic capacity of lifeboats in feet. |
|---|---|---|---|
| Feet. Feet. | | | |
| 100 and under 120 ... | 2 | 2 | 980 |
| 120 „ 140 ... | 2 | 2 | 1,220 |
| 140 „ 160 ... | 2 | 2 | 1,550 |
| 160 „ 175 ... | 3 | 3 | 1,880 |
| 175 „ 190 ... | 3 | 3 | 2,390 |
| 190 „ 205 ... | 4 | 4 | 2,740 |
| 205 „ 220 ... | 4 | 4 | 3,330 |
| 220 „ 230 ... | 5 | 4 | 3,900 |
| 230 „ 245 ... | 5 | 4 | 4,560 |
| 245 „ 255 ... | 6 | 5 | 5,100 |
| 255 „ 270 ... | 6 | 5 | 5,640 |
| 270 „ 285 ... | 7 | 5 | 6,190 |
| 285 „ 300 ... | 7 | 5 | 6,930 |
| 300 „ 315 ... | 8 | 6 | 7,550 |
| 315 „ 330 ... | 8 | 6 | 8,290 |
| 330 „ 350 ... | 9 | 7 | 9,000 |
| 350 „ 370 ... | 9 | 7 | 9,630 |
| 370 „ 390 ... | 10 | 7 | 10,650 |
| 390 „ 410 ... | 10 | 7 | 11,700 |
| 410 „ 435 ... | 12 | 9 | 13,060 |
| 435 „ 460 ... | 12 | 9 | 14,430 |
| 460 „ 490 ... | 14 | 10 | 15,920 |
| 490 „ 520 ... | 14 | 10 | 17,310 |
| 520 „ 550 ... | 16 | 12 | 18,720 |
| 550 „ 580 ... | 16 | 12 | 20,350 |
| 580 „ 610 ... | 18 | 13 | 21,900 |
| 610 „ 640 ... | 18 | 13 | 23,700 |
| 640 „ 670 ... | 20 | 14 | 25,350 |
| 670 „ 700 ... | 20 | 14 | 27,050 |
| 700 „ 730 ... | 22 | 15 | 28,560 |
| 730 „ 760 ... | 22 | 15 | 30,180 |
| 760 „ 790 ... | 24 | 17 | 32,100 |
| 790 „ 820 ... | 24 | 17 | 34,350 |
| 820 „ 855 ... | 26 | 18 | 36,450 |
| 855 „ 890 ... | 26 | 18 | 38,750 |
| 890 „ 925 ... | 28 | 19 | 41,000 |
| 925 „ 960 ... | 28 | 19 | 43,880 |
| 960 „ 995 ... | 30 | 20 | 46,350 |
| 995 „ 1030 ... | 30 | 20 | 48,750 |

When the length of the ship exceeds 1,030 feet the Board of Trade shall prescribe the minimum number of sets of davits and the minimum numberof open boats.

## APPENDIX II.

TABLE SHOWING THE MINIMUM AGGREGATE CUBIC CAPACITY OF LIFEBOATS TO BE CARRIED IN A SHIP IN CLASS I., HOME TRADE, LAUNCHED ON OR AFTER THE 1ST MARCH, 1913, OR IN CLASS V., HOME TRADE, LAUNCHED AFTER THAT DATE (EXCEPT IN CERTAIN CASES).

| Length of vessel in feet. | Minimum aggregate capacity of lifeboats, in cubic feet. |
|---|---|
| 100 and under 120 | 400 |
| 120 „ 140 | 600 |
| 140 „ 160 | 850 |
| 160 „ 175 | 1150 |
| 175 „ 190 | 1300 |
| 190 „ 205 | 1450 |
| 205 „ 220 | 1600 |
| 220 „ 245 | 1850 |
| 245 „ 270 | 2350 |
| 270 „ 300 | 3000 |
| 300 „ 330 | 3750 |
| 330 „ 370 | 4400 |
| 370 „ 410 | 5100 |
| 410 „ 460 | 6000 |

In the case of a vessel of under 100 feet, or over 460 feet, the cubic capacity of the lifeboats to be carried shall be prescribed by the Board of Trade.

## SECTION XXX.

## STOWAGE

Knowledge as to the proper stowage of cargo is required from every merchant officer, and it is therefore necessary for the young seaman to take every opportunity of learning this branch of his profession.

Now the commodity of which we export the largest quantity is coal, so we will begin with that. In stowing this cargo, trimmers are employed in all the coal ports, and the mate must see they do their work well, remembering that *small screened* coal will shift like grain, and, therefore, wants careful trimming. He has also to watch the draught of the ship to see that she is not put too deep, or too much by the head or stern; and also that, towards the finish, she is kept upright. It is always included in the trimmer's contract that the vessel is to be left upright, but too often they are allowed to leave the vessel with a list, which, if she goes out into a heavy beam sea, may get worse and worse till an accident happens. The mate should also see that there is an air passage left over the surface of the cargo, so that any gas given off can reach the ventilators. As a rule this will always be the case in the wings, however well the trimmers do their work.

Many coal-laden vessels have been lost through bad trimming

Some kinds of coal shift easily, and the mate cannot be too careful in seeing that the trimmers do their work. With the modern heavily-sparred and narrow beamed four-master, shifting boards are, with some coals, a *necessity*, notably with that shipped at Newcastle, N.S.W., where not only should shifting boards be used, but the coal must be secured *thoroughly* at the ends. A ship fitted with fore-and-aft shifting boards, and with cargo well trimmed, left that port with a small empty space at the fore end. She got into a sudden heavy gale, took a very heavy "scend" forward, which shot the cargo into this space: by putting the helm up and letting fly the after-sheets, she was *just* saved; but the captain thought she was gone.

No class of coal can be said to be absolutely safe, and therefore it is necessary to take ordinary precautions to make it so.* Each compartment should be provided with two ventilators of good size, one at each end, to ensure a thorough system of *surface* ventilation; they should merely come through the deck, and in no case go into the body of the cargo; they should be kept open the whole voyage, except in case of fire, and especially so with Welsh coal, which is the most dangerous of all coals for giving off explosive gas in large quantities during a long voyage. A vessel laden with Welsh coal has been known to keep her ventilators and hatches open till after getting into the Mediterranean, and then, having plugged everything up, to have the whole after end of her blown up, from a match struck in the lazarette, *only a few hours* after the hatches were put on. North country coal is most liable to give off gas for the first few days after shipping, though it is never absolutely safe.

In sailing vessels bound on long voyages another danger comes in, namely, spontaneous combustion. All kinds of coal are liable to this, though perhaps some of the north country kinds are most dangerous from this source, and will want most careful watching.

It therefore comes to this—that Welsh coal is liable to explosion from the minute it comes on board until it is discharged, bunker coal being liable to a similar accident, and is also liable to spontaneous combustion. North country coal is dangerous (particularly if shipped wet) for the first few days especially from explosion, and then (if it has been properly cleared from pyrites) it is not so dangerous from this source, but is liable, after being some time on board, to generate heat, and catch fire by spontaneous combustion. Some kinds of bituminous coal, however, are far more gaseous than others, and *all* should be ventilated.†

* See the official caution with regard to this subject issued by the Board of Trade.

† The dangerous time on a long voyage occurs when a vessel has been obliged to batten all down for any length of time.

A sailing vessel loading a cargo of coal for such a port as Valparaiso should be carefully prepared for its reception. Care should be taken that the bottoms of the iron masts are plugged up, and that there are no rivet holes open in them in the holds; it is also wise to secure their mastheads, so that no air can get down. The lazarette bulkhead and deck should be tight, so that gas cannot find its way into it. Sail-rooms, &c., should also be carefully seen to in a similar manner, and also the lower forecastle, should there be one. An iron gas-pipe should be secured up and down in each hatchway, with plugs fitted to their tops, and their lower ends closed to prevent air getting down into the cargo; these are for lowering a thermometer down each day during the voyage to test the temperature. A thoroughly efficient system of surface ventilation should be provided, and if (as is very commonly the case) there should be a large cowl over an open pump-well, a platform should be fitted into it on a level with the cargo, and this should be caulked so that no air can get down into the pump-well, and thus into the body of the cargo; and then a few augur holes of good size should be bored in the sides of the pump-well *above* this platform, to turn this into a *surface* ventilator. The coal should, if possible, be lowered into the hold, and breakage avoided as much as possible. It should also be shipped dry.

During the voyage the temperature should be tested day by day, and whenever possible the hatches should be kept off. If undoubted symptoms of fire show themselves, everything, ventilators included, should be tightly battened down, and the method given in article "Sailing Ship on Fire" should be resorted to, the vessel's head being put for the nearest port.

Masters should remember that courts of enquiry hold masters responsible for the proper ventilation of their vessels. Some actual cases of disaster from coal cargoes are here given as warnings of what may occur to any vessel with a cargo of coal on board. Numbers of vessels coal laden from the N.E. ports have been burnt at sea from similar causes; many have never been heard of.

## A CASE OF SPONTANEOUS COMBUSTION.

The barque L—— S—— loaded coal at Sunderland for Melbourne, and reached her destination in safety. When discharging the 'tween deck coals all went well; but on getting down into the lower hold a few feet the coal was found very hot. It became at last so hot that the crew had to stand on planks to work it. At last the heat became unbearable. The master then ordered water to be thrown and pumped

into the hold. As soon as ever the water went down, the ship became enveloped in steam over her mastheads. The harbour authorities then brought a tug alongside, and pumped five feet of water into her, and presently the steam ceased—the fire was out.

She was a good hard-wood ship, nearly new. When she was all discharged, 37 skin planks of English elm were found all burnt through. The upper and lower greenheart keelsons were burnt into tinder for about 35 feet *in the wake of the main hatch,** and nine of the floors were burnt half through. She had to go on the patent slip at Melbourne to be repaired, and the fore and main masts had to be lifted to get the scarph bolts of the upper keelson drifted out.

Experts said she must have been on fire for two or three weeks previous to her arrival. *The cargo was shipped in very wet weather.* Wet makes coal doubly dangerous.

### A CASE OF EXPLOSION—NORTH COUNTRY COAL.

The s.s. S——d was going up the Kattegat coal-laden. Being a fine day, the mate had the cables hove on deck, for the purpose of cleaning out the lockers. When they were up he took a lamp down into the lockers to inspect them. The glass being dirty, he opened the lamp to see better. All at once blue fire began to run about the floor of the locker. A moment afterwards a terrible explosion took place, and he became insensible. She blew her fore deck up, smashing the iron deck beams, and her foremast went over the side. They, however, got her safely into Copenhagen. The mate was found at the bottom of the locker, still alive, but frightfully injured and burnt. He however ultimately recovered.

### A CASE OF EXPLOSION—WELSH COAL.

The s.s. R—— loaded at Cardiff for the Mediterranean. She had a fine passage, and kept her ventilators and hatches open till after passing Gibraltar; then, however, the hatches were put on, and the ventilators, which were not provided with cowls, were also plugged up. Two men were shortly afterwards sent down into the lazarette for something. *One of them struck a match.* Immediately the whole iron after-deck was blown up as far as the bridge, wrecking the whole after end of the ship. The two men were both badly injured, but not fatally. Her repairs cost a very large sum of money.

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* The place where spontaneous combustion generally occurs, owing to so much breakage of the coal there.

## GRAIN.

Grain is perhaps the next most dangerous cargo to deal with. There is a special Act of Parliament regulating the loading of this cargo, also a number of official regulations on the same subject issued by the Board of Trade, which the young seaman should obtain for his information.

The requirements of the Act are as follows :—

In a grain laden ship (that is, a vessel carrying more than one-third of her register tonnage* of grain), loading from North America or from the Mediterranean or Black Sea :—

(*a.*) There shall not be carried between the decks, or if the ship has more than two decks, between the main and upper deck, any grain in bulk except such as may be necessary for feeding the cargo in the hold, and is carried in properly constructed feeders.

(*b.*) Where grain (except such as may be carried in properly constructed feeders) is carried in bulk in any hold or compartment, and proper provision for filling up the same by feeders is not made, not less than one-fourth of the grain carried in the hold or compartment (as the case may be) shall be in bags, supported on suitable platforms laid upon the grain in bulk. Provided that this regulation with respect to bags shall not apply

(i.) To oats or cotton seed ; nor

(ii.) To a *sailing* vessel of less than 400 tons register, and not engaged in the Atlantic trade.

(iii.) Nor to a Black Sea or Mediterranean trader, if the ship is divided into compartments of not more than 1,500 quarters (375 tons), each with a properly constructed feeder of 2% of its capacity (measured from the underside of the deck upwards), and with shifting boards from deck to keelson with beam fillings, and not more than one-fourth of her grain cargo in any one compartment.

(iv.) To a ship in which the grain cargo does not exceed one-half of the whole cargo of the ship, and the rest consists of cotton, wool, flour, or other suitable cargo, so stowed as to prevent the grain in any compartment, bin, or division from shifting.

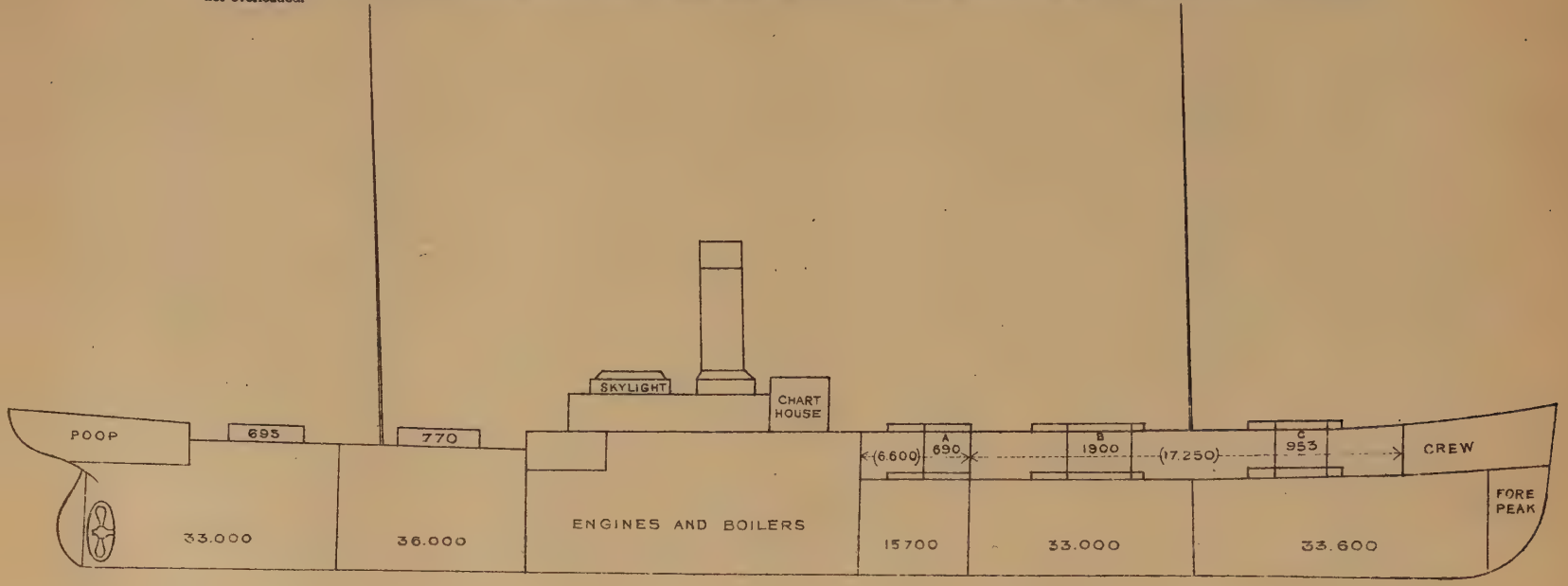
(*c.*) Where grain is carried in the hold or between decks, whether in bags or bulk, the hold or space between the decks shall be divided by a longitudinal bulkhead, or shifting boards, extending right up and down, with beam fillings, and grain tight if the grain is in bulk.

* This third is computed at the rate of 100 cubic feet to the ton ; or by weight, at two tons weight to the ton.

# MODERN TYPE OF GRAIN CARRYING CARGO STEAMER.

## *SHOWING CUBIC CAPACITIES IN FEET.*

**With arrangements that would probably secure her exemption from the Grain Carriage Act (see foot-notes) if she were in all other respects a good staunch ship, and well found, and of such relative dimensions as would ensure her stability. In addition to this it would be required that not more than one-sixth of the entire grain cargo is stowed in bulk in the 'tween decks, that it is carried in bins of not more than 375 quarters each, and that such bins, as well as the lower holds, are properly and sufficiently fed, the hatchways being trunked to furnish the feeders for lower holds, &c. All grain in excess of one-sixth of the cargo, carried in the 'tween decks, must be in bags. Care must also be taken that the provisions of the Statute as to the longitudinal bulkhead or sufficient shifting boards, and as to careful loading and trimming, are complied with, and that the vessel is not overloaded.**




The 'tween decks forward measure { 6600 / 17250 }

Of the full quantity of cargo carried in the fore part of the ship (before the Engine Room) not more than one-eighth should be in the 'tween decks, and this one-eighth should be in grain-tight bins, each not to exceed 375 quarters, and having its own feeder.

*a* = 690
*b* = 1900
*c* = 953
} are trunk feeders to lower holds. { the other parts of the hatchways feed the 'tween deck bins.

The after hatches are sufficiently large to act as feeders, being over 2 per cent. of the capacity of their respective holds.

*Plate No. 112.*

(*d.*) In loading, the grain shall be properly stowed, trimmed, and secured.

These precautions of the Act do not apply to ships loaded to Board of Trade regulations,* which include—

UNITED STATES.

Rules of the Board of Underwriters of New York.

Rules of the National Board of Marine Underwriters of New York.

Rules of the New Orleans Board of Underwriters.

Rules of the Wheat Tariff Association, San Francisco, Wheat Cargoes one-third in bulk.

Regulations adopted by the Board of Marine Underwriters of San Francisco for Grain Cargoes in bags.

CANADA.

Rules and Bye-laws of the Port-warden of Montreal.

## OFFICIAL NOTICE. II.

Mediterranean and Black Sea. Grain in bulk stowed with other cargo in bags, and light grain in bulk in the 'tween decks. The wording of this last is as follows :—

1. In the case of single-decked ships loading a grain cargo at a port in the Mediterranean or Black Sea, where no provision is made for feeding the hold, and where, according to the requirements of the Eighteenth Schedule of the said Act, one-fourth of the grain carried in any one compartment, bin, or division must be in bags, the Board of Trade have approved a regulation that the whole fourth, or any part of the fourth, of the compartment, bin, or division which would, according to the requirements aforesaid, be stowed with grain in bags, may in lieu thereof be stowed with bales of cotton, bales of grass, or bags of flour, or other suitable cargo ; provided always that the substituted cargo be supported on suitable platforms laid on the grain in bulk, and be so stowed as to prevent the grain from shifting.

2. In the case of ships having two decks, oats, cotton-seed, or barley, may be carried in bulk in the 'tween decks, provided that—

(*a*) Grain-tight feeders be fitted from the lower hold through the hatches to the uppermost deck : such feeders to contain not more than six per cent. and not less than three per cent. of the quantity carried in the hold or compartment they feed. These feeders must not interfere with or decrease in any way the two per cent. which is required to feed the grain carried in the 'tween decks.

Or (in lieu of the regulation contained in the paragraph (*a*) above) may be substituted the following :—

(*b*) That the between deck hatches shall not at any time be put on ; and

(*c*) That strakes of the deck be lifted, or if the deck is an iron deck, sufficient openings be made through the deck in the wings, which with the open hatches shall admit of the cargo in the between decks feeding the lower hold.

The regulations contained below shall also be observed whether the ship is loaded under the regulation contained in paragraph (*a*) above, or in accordance with the regulations contained in the paragraphs (*b*) and (*c*) above ; that is to say,

(*d*) There shall be longitudinal grain-tight shifting boards in accordance with Clause 3 of the Eighteenth Schedule of the said Act, and the grain shall be properly stowed, trimmed, and secured, as required by Clause 4 of the said Schedule.

(*e*) Feeders shall be fitted to feed the grain carried in the between decks, such

*The usual requirements of the Board of Trade in vessels exempted from full compliance with the carriage of grain clauses in the M. S. Act, will be found on the plate, No. 112, facing page 220.

feeders to contain not less than two per cent. of the compartments they feed. If strakes of the deck be lifted, or sufficient openings are left to enable the grain in the 'tween decks to feed the lower hold, then it is obvious that the feeders must contain at least two per cent. of the compartments they feed, *i.e.*, the 'tween decks, plus the lower hold.

(*f*) The space in the 'tween decks in which the grain in bulk is carried shall be bounded at each end by grain-tight transverse bulkheads or partitions extending from deck to deck.

(*g*) The ship shall not be overloaded.

A declaration must be made by the master abroad to the British Consul, or the principal officer of Customs, that the ship is properly stowed; and on arrival a similar notice must be given to the Customs. For failing to give this notice, or for making a false statement, the penalty is £100, and both master and owner, and also the agent abroad, are liable to penalties under the Act if the cargo is not properly stowed.

A large percentage of accidents from grain cargoes shifting can be traced to the fact of the bulk grain being sloped away at the ends, instead of being trimmed up square against a bulkhead.

And this is the principal danger in ships which infringe the Act. The 'tween deck bulk grain is not built up in a solid mass and secured by a bulkhead at the ends, but is sloped away, and an attempt made to secure it by laying a sail over the slope, with perhaps a few bags or the winch chains laid on top. This is most dangerous, and useless as a means of security, and many vessels have been lost through this seemingly simple cause.

## GENERAL CARGOES.

In preparing a hold for any kind of cargo, the limbers and water-courses should be carefully cleared out after the hold has been cleaned; and the pump-well in a sailing ship, and the strums and sluices in a steamer, should be carefully inspected.*

The ordinary average thickness of dunnage for fine cargoes in a first-class wooden vessel is 9 inches on the floors, 14 inches in the bilges, 3 inches at the sides.

An iron vessel is usually ceiled up above the round of the bilge, and up the rest of the side fixed cargo battens of 2-inch stuff are secured. This is sufficient dunnage for ordinary purposes, care being taken that

* Before loading, the water ballast tanks require close attention, to see that they are dried out. Three or four inches in a main tank may mean (in a flat-bottomed ship of ·82 co-efficient and 6,000 tons gross) shutting out perhaps 50 tons of cargo. Again, vessels which have been to such places as Rangoon, should have their tanks washed out if necessary. Cases have been known of as much as 14 in. of mud in ballast tanks: this is, of course, still heavier than water, and would cause the shutting out of still more cargo.

fine goods of all kinds are kept off the iron frames and stanchions; a small thickness of dunnage is also necessary on the ceiling, to guard against drainage of sweat. The pieces on the bottom should be laid fore and aft, unless on a ballast-tank top, when it is laid athwartships, to allow any water a course to the gutterways at the side; on a ceiling, also, it should be laid athwartships. In the 'tween decks dunnage is laid athwartships at a thickness of 2 inches.

In a wooden or composite ship of any age, extra dunnage will be necessary about the pump-well and bilges, in the wake of the chain-plates and transoms, and in all vessels round the masts.

Damaged goods should never be received unless under special order, and goods found damaged at the end of a voyage should not be broken out until surveyed, nor should they be delivered till the exact nature and extent of the damage is ascertained. All shipping notes should be kept.

Casks of liquid should be stowed level, bung up, bilge free, fore and aft, and bilge and cuntline on the upper tiers. Begin to stow from amidships towards the sides and ends of the ship. In stowing the ground tier, four beds should be used to each cask, and they should be carefully wedged off with quoins. A cask carefully stowed according to these instructions will bear a great weight without taking any hurt. Care must be taken that it is "bilge free" not only at the bottom, but also at the sides and top. The term "bilge and cuntline" is explained in the accompanying sketch; here the ground tier casks are shewn dark, the spaces between them at *C, C, C,* are the cuntlines in which the bilges of the upper tier of casks, shewn by dotted lines, lie. Pipes or butts may be stowed three tiers high, and no more; puncheons four heights, hogsheads and tierces six heights,* barrels of light stuff, flour, &c., eight heights. All barrels, dry or wet, should be stowed with the head pieces perpendicular; in a wet cask this will be so when the bung is up, but this must also be seen to in a dry cask.

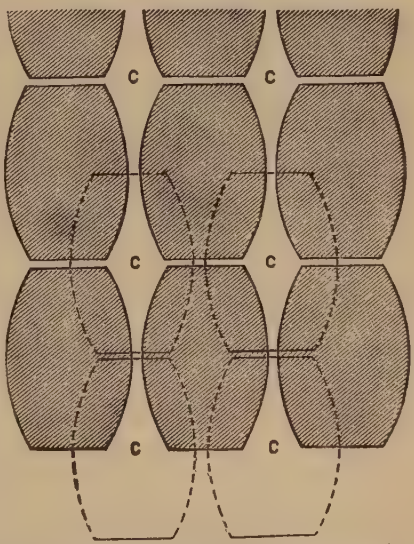



*Plate No. 113.*—The dotted lines shew the casks in the upper tier. These rest with their bilges in the cuntlines formed by the casks of the lower tiers at C.

* A pipe contains 126 gallons, a puncheon 84 gallons, a hogshead 63 gallons.

Bales are stowed on flat amidships, mark up; on edge in the wing, mark inwards. Cases always mark up. Do not let a bale lie against any ironwork.

A full cargo of rail iron was thus stowed :—The rails were immersed in oil,* and then covered with sand. Inch planking was laid on the ceiling, from the keelson to the turn of the bilge. Then one tier of rails fore and aft, close together, from 4 feet abaft foremast to 4 feet before mizzenmast. 3-inch planks were laid, 8 feet apart, up and down against the ship's side, against which rails were laid fore and aft, forming a lining.

Above the lower tier the rails were stowed diamond and checquer fashion † (the ends of the rails butting on the lining at the sides) to within 3 or 4 feet of lower deck beams. Then a locked or flanged tier was laid on the top of all.

Under every other beam 3-inch planks were placed on the locked tier, and shores of spruce, 3-inch thick and 9 to 11 inches broad, were driven between the beams and planks, being notched to take the beams, and cleated to the planks. Ties of 1-inch plank were nailed to the shores, about a foot below the beams, right across the vessel, and secured to the battens at the sides. The cargo was sloped a little fore and aft from the bottom to the top tier.

The 'tween deck was made level with dunnage, planks were laid up and down against the sides, with a lining of rails against them, as in lower hold. The cargo ports were well protected. A close tier of rails was laid fore and aft at the bottom, from the wings to the hatchways (the vacant spaces amidships were filled up with planks). Then lashing rails were laid two and two at every beam, and across main hatchway. Then a fore and aft flanged tier, with inch planks at intervals. Then a flanged tier fore and aft. On this were laid two-inch planks, three to every length of rails. Then a flanged tier fore and aft, and another fore and aft tier from fore part of main hatch. Six lashing bars were placed on top. 3-inch planks were laid under every other beam from which the cargo was shored to the beams, the shores being tied and cleated as in lower hold. Chain lashings were passed round lashing bars, and wedged tight; and wedges were driven throughout the cargo where possible. With all this care the 'tween deck cargo broke adrift, and the vessel was lost; and whether with grain, iron, or any other cargo, if anything shifts, it is nearly always in the 'tween decks. Therefore, 'tween deck cargo

* This is a very questionable practice, and was probably the cause of this cargo shifting.

† Checquer fashion throughout would probably have been safer.

should be very carefully stowed, and nothing liable to shift should be placed there.

An East Indiaman, with some hundreds of tons of railway iron in her bottom, general cargo on top, discharged part cargo at Madras, and proceeded for Calcutta. She got into a cyclone, her cargo shifted, and she went over on to her beam ends, and had to cut away her masts. She was, however, got safely to Calcutta, and when the iron was reached it was found to have fetched way bodily into the wings taking the 'midship stanchions with it, and there was a passage fore and aft along the bilge underneath it. Such an occurrence would have foundered any but a very strong-built vessel.

Strong smelling goods, or those liable to leakage, must be kept apart from fine goods, and should never be stowed on top of them. Cases of oilskins or oilcloth are liable to spontaneous combustion; they should only be carried on deck. Acids also must be carried on deck, and in case of breakage should at once be hove overboard. Caution must be used when a cargo of nitrate of soda or saltpetre is on board. Nitrate especially is liable to fire, and, if it does, gives very short time to get the boats out. Never allow a naked light to be taken below with such cargoes on board. The wooden ship C—— loaded a cargo of nitrate at Iquique. Some days after leaving the watch went down into the fore peak for provisions with a naked light. No one could give any account of what happened, but in a moment the ship was in flames, fore and aft, and her crew had only time to get one boat out, some of them jumping overboard. The fire was seen by a whaler, who bore down and rescued them.

Nitrate of soda is, *by itself*, not combustible, and can only burn in conjunction with the carbon in the bags, and wood of the ship.

On the first alarm of fire, if it is possible to approach the seat of it, cut open the nearest bags, throw the sacking out of the way, and endeavour to smother the fire with the nitrate.

A mixture of nitrate and water (either fresh or salt), called on the coast *aqua vieja*, will quench a nitrate fire. Plain water alone will cause explosions, and tend to spread the flame.

It is commonly believed that a cargo of nitrate on fire is liable to explode. This is not so,—it will only explode if it comes in contact with plain water.

Many cases of fire occur in cotton-laden vessels from the United States. The opinion of those best able to judge of the cause is that it is owing to the miserable way in which American cotton bales are packed, and also from the method of sampling. The bales in the first instance are very loosely pressed, containing only about 12 lbs. to the

cubic foot. The covering is open, flimsy stuff, and the bands are quite insufficient for their purpose. Bales are sampled by a piece of the covering being cut away, a cut being made in the bale and a hand inserted. A portion of the cotton is then pulled out from the inside of the bale, leaving a lot of fluffy cotton on the outside of it.

Practically no fires occur in Indian or Egyptian cotton, which are pressed to about double the density, and are well protected with bands.

There is no such thing as spontaneous combustion in cotton, unless it is in contact with oil; but the least spark is enough to fire a bale of American cotton.—*(Mr. R. N. Dale's evidence in the case of S.S. "Egypt.")*

### Suggested Rules for Steamers loading Cotton.

1. All cotton on wharf or deck to be kept covered with tarpaulins, and not allowed to be uncovered, except at such times as are necessary for drying out cotton after rains, or while work is actually going on.

2. A competent watchman belonging to an approved police force shall be employed to watch the cotton at night, and at all times when the ship is not at her wharf; during the day, unless a competent person belonging to the vessel is detailed to watch the cargo and see that the rules are properly carried out, the ship should employ a shore watchman as above.

3. Steam shall be kept up night and day, with hose kept ready and in position, so that a strong stream of water may at any moment be turned into any compartment of the vessel.

4. Every vessel shall fit spark-arresters to the donkey and galley funnels before commencing to load, unless such funnel is carried into the main funnel, and that protected.

5. All hatch combings shall be protected, during loading, by some material out of which it shall be impossible to raise a spark through the iron bands of bales striking against same.

6. The officers of the vessel shall take every precaution to see that all possible steps are taken that will prevent risk of fire during loading.

7. Smoking is positively prohibited on the wharf, in the holds, or on the deck of the vessel.

8. No vessel shall load between sunset and sunrise, unless steps be taken to establish conclusively that no risk of fire is thereby incurred.

9. No lights to be allowed in the holds at any time, except such light be an approved closed and locked lantern.

10. That, in company of the roundsman of the police employed by the ship, one of the ship's officers or night watch shall remove sufficient of each hatch of the ship to enable him to ascertain whether there is any sign of fire in any of the holds, at least twice a night—once before midnight, and once after midnight.

11. That all hatches shall be put on and covered with tarpaulins in the presence of the officer of the vessel, who shall previously examine and ascertain that no signs of fire are visible in the compartment.

12. That animal oils only shall be allowed for the purpose of lubricating screws, that the officers of the vessel shall take notice of all oil-cans that are brought on

board, and ascertain that all are removed from on board, that no oil-can shall remain in the vessel's hold over night, but shall be removed from the holds and placed in the lamp room before hatches are put on.

13. Paint oil is the most dangerous generator of spontaneous combustion, and no painting shall be allowed in holds while loading cotton.

14. Ventilators and all other openings into holds should be securely closed, as such openings afford opportunity for careless or evil-disposed persons to introduce fire.

15. A bucket of water at the right moment is better than a fire-engine, and the precaution of barrels at each hatch full of water, with sufficient buckets, is therefore very commendable.

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FIRES ON BOARD VESSELS CARRYING FLAX.—The loss of the *Merope*, and the casualty to the *Winefred*, both vessels carrying flax, amongst which cargo fires occurred, awakened considerable curiosity as to the causes of such outbreaks, with a view to their prevention in future. Interviews with the respective masters were held, and inquiries made of those conversant with the article, and the conclusion arrived at was that the dryness of the flax before shipment was of paramount necessity—that packing in wrappers (gunnies to be preferred) was of great importance—and that its stowage on board, apart from all cargo of a greasy nature, was indispensable. If these conditions were carefully observed, it was considered that a reasonable expectation of immunity from danger might be looked for.

COTTON ON FIRE AT SEA.—Steam is preferable to water for extinguishing a cotton fire, but in case of a sudden blaze whilst loading, the *loss of time* in battening down and getting the steam to play might be fatal.

Steam will hold it in check, and has in many cases enabled vessels to reach port. Batten down everything tight and turn on steam. *Keep the steam going.* The decks and shell plating may possibly get very hot, *never mind this.* The decks should NOT be cooled with water, but allowed to remain hot.

If there is grain below the cotton, extra fastenings will be required to the hatches, as the up pressure will become heavy through the grain swelling.

GUNPOWDER should have a compartment specially built for it, close to a hatchway; copper nails only should be used in its manufacture. This magazine should not be opened for discharging until the lighter is alongside for the powder, and the galley and all other fires out; and the men discharging it should not be allowed to wear their boots, for fear of sparks from the nails.

Liquid Ammonia should only be received in iron vessels, carefully tested (at the very least) up to a pressure of 675 lbs. to the square inch, and it should be stowed away from engine-room and crew spaces.

Benzoline or Petroleum are dangerous from leakage. Either of these in *best* casks, glue lined, escape on a voyage from America to the extent of from 2 to 4 °/₀. This makes an inflammable and explosive mixture with air. Actual flame is necessary to cause combustion, a struck match being the very general cause of explosion both with such cargoes and with coal. Tins of American petroleum in cases, and Russian petroleum also, will be found to leak and cause a similar dangerous mixture.

Some kinds of petroleum, usually termed Benzoline, are of such dangerous qualities, that 1 volume of the vapour will render 16,000 volumes of air inflammable; 1 volume of the same vapour will render 5,000 volumes of air strongly explosive, if brought into contact with flame.

Carbon bisulphide (in French, *sulphure de carbone*), shipped at Marseilles and elsewhere, is very dangerous, and should not be taken unless a compartment between two watertight bulkheads, not communicating with any other part of the ship, can be appropriated to its use. This compartment should be most thoroughly ventilated, and out of any danger from fire or sparks. The greatest care should be taken that the drums the stuff is packed in are in the very best order, and any package showing the least sign of leakage should be entirely rejected: the very greatest care is necessary in its stowage. This chemical gives off a vapour which will fire at an extremely low temperature, and a spark of any kind would start it immediately. On mixing with air it becomes explosive and inflammable at once (one gallon rendering 2,860 cubic feet inflammable). It is *not* liable to spontaneous combustion: leakage will declare itself by the smell of sulphur which accompanies it.*

Esparto grass has been known to take fire by spontaneous combustion due to heating. Rags are liable to the same danger.

Cylinders of anhydrous ammonia, which are exported to the River Plate for the purposes of meat refrigerating, should also be carefully looked after and stowed by themselves. This chemical is very sensitive to increase of temperature, and the tubes or cylinders are liable to explode.

Cases of oil-skins, oilcloth, and some kinds of felt, are very dangerous to store amongst general cargo, being liable to spontaneous combustion.

Some descriptions of sulphuric iron ore are also dangerous from similar causes, and if shipped before thoroughly kiln dried, will fire, and *cannot be put out.* It is usually shipped in 100 lb. bags.

* Dr. Dupré's evidence in the case of S.S. *Livadia*, which vessel was lost by fire and explosion from this source only one day after leaving port.

A ship with a mixed cargo of jute, saltpetre, and cutch, took fire, it is supposed, by spontaneous combustion, and had to be run ashore and scuttled. The fire started forward, and it is possible arose from a careless seaman taking a naked light below, saltpetre being much of the nature of "nitrate," already referred to.

The carriage of petroleum in bulk can hardly be said to have yet passed the experimental stage. Care must be taken to be sure of the stability of vessels fitted for this purpose when laden.

With general cargoes the chief causes of damage, other than bad stowage, generally arise from some such reasons as the following:— From the East Indies, leakage, from castor oil cases, and damage from indigo. Dry goods under liquids. Fine goods, as tea or coffee, stowed close to tar or turpentine, &c., or with a large bulk of raw sugar. Too many heights of casks without an intervening 'tween deck. Damage by lumper's hooks in bales, &c., &c.

Such cargoes as grease, palm oil, whale oil, or molasses in casks, are bad cargoes to have anything to do with, so much so that a badly rolling vessel, if known as such, will not be chartered in the West Indian trade to carry molasses; whilst if a whale ship intends to send whale oil home by a strange vessel, the crew will come aboard themselves to stow it.

It is almost impossible to stow such freight as this securely in a vessel that rolls heavily, and it is better in such a ship to refuse cargo of this kind.

A small steamer took part cargo, molasses, from a disabled vessel at Bermuda for Halifax, N.S. The second mate, strange to the trade, but seeing the kind of stuff it was, started to stow the casks athwartships in the 'tween decks (which was the only place available). However, when two longers were stowed, the mate (an old West India hand) came down and reversed the order, and stowed the remainder himself, fore and aft, in the usual way. A day out from Bermuda a westerly gale came away. The vessel began to roll, and started the casks. An utterly fruitless attempt was made to get down into the 'tween decks, and the ship was put head on to steady her. Every cask was found adrift, except those which were stowed athwartships, which all stood fast, and all but these were stove. The stuff found its way to the stoke-hole, and rose to within an inch or two of the fires.

A steamer's compartment is prepared for a cargo of frozen meat as follows:—The hold is lined with an ordinary ceiling; this is covered with sheet zinc; then comes six inches of lump charcoal; then solid double battening of two inches total thickness; and, above all, inch battens about a foot apart, running transversely to allow an air

passage under the cargo. [The full amount of thickness of insulation being 8 inches.]

SECTION OF A LOWER HOLD PREPARED FOR FROZEN MEAT.

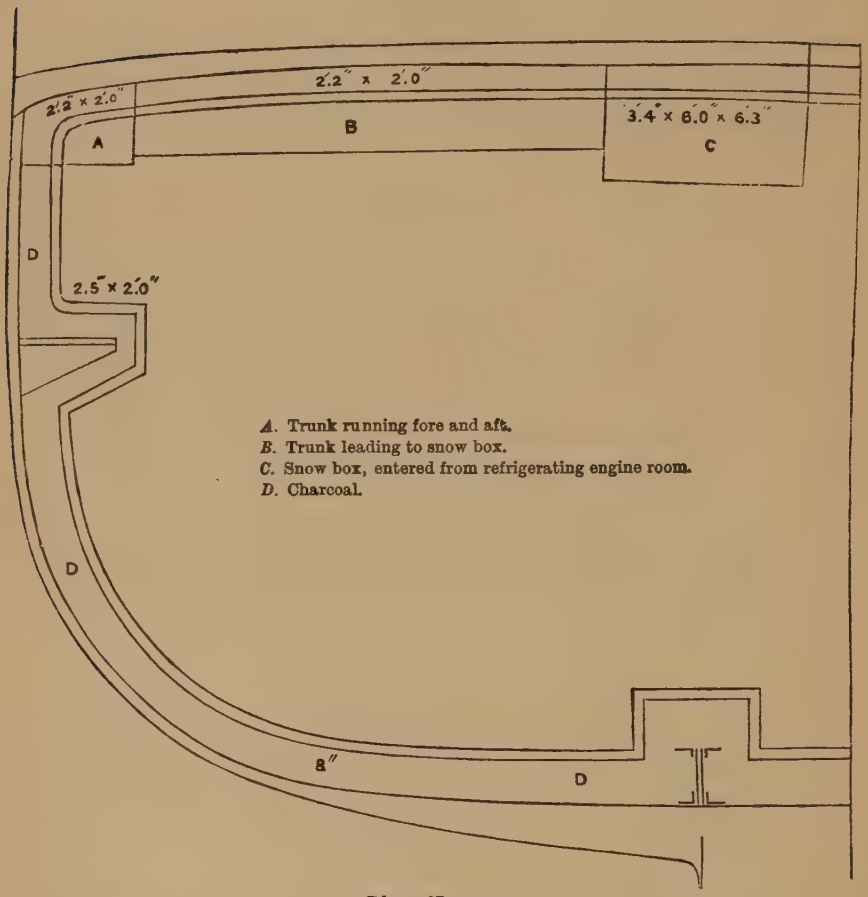


*Plate No. 114.*

Masts, stanchions, bulkheads, the under part of deck, beams, stringers, &c., are all treated in a similar manner. Along the sides, close up under the deck in the wings, run wooden trunks, with here and there small square holes about 6 inches by 3 inches. Through these the cold air from the refrigerating engine is forced into the hold, and by help of 'thwartship battens under the cargo, finds its way all over the compartment. These trunks are led into a snow-box, which is entered from the refrigerating engine-room. Every four hours during the voyage the engineer in charge goes along these trunks, sees that

the holes are clear of snow, and draws the snow into the snow box, which is cleared now and then as required.

Before the meat is received the hold is thoroughly washed out with soda water. The cargo is taken in and stowed in as solid a mass as possible. The hatches are then put on and carefully chintzed, caulked and payed, and made perfectly tight.

With jute, rice, and many other cargoes, great care should be taken that stringer plates and waterways are properly drained, so that the sweat cannot damage the cargo; and also that the holds are adequately ventilated.

A steamer's hold was prepared for a rice cargo as follows:—"Planks 8 in. broad by 1⅛ in. thick were fastened to either side of the ship's stanchions, giving an air space of about 6 in., and thus dividing the cargo down the centre throughout length and depth of each hold. A set of box ventilators in single line, midway between the centre and sides of the ship, was laid down under the bottom tier of bags, and in holds 1, 3, and 4 a similar set on every subsequent fourth tier. But in hold No. 2 the sets of ventilators, all except the bottom one, were in double line, *i.e.*, two lines run fore and aft through the cargo at equal distances between the sides and centre of ship. All ventilators had a clear lead, either direct or by cross ventilators, into the vertical ventilators placed in the corners of the hatchways and under the ship's permanent deck ventilators (bell-mouthed, eleven in number). The ventilators are constructed of 2-in. boards, 8 in. broad by 1¹ in. thick, and held apart by battens 8 in. long by 2 in. broad, and 1 in. thick. The dunnage was supplied by the stevedore as customary, and consisted in the bottom of holds of billets of wood of about 3 in. in diameter laid athwart the bilge limbers, with gran-sticks fore and aft on top. The floor or water-ballast tank top ceiling was dunnaged with cross-layers of gran-sticks. The sides of lower hold were dunnaged with gran-sticks fastened up checkerwise to the ship's permanent cargo battens, and in the 'tween decks were closely checkered by clean, dry bamboos. The iron 'tween decks from right fore to right aft was dunnaged in the outer part with the 'tween decks hatches, and the inner part with crossed tiers of sticks. All iron bulkheads were stick or bamboo dunnaged."

In stowing jute, bales should not exceed 400 lbs. gross weight. They should be stowed so that the level of the top tier of bales is below and clear of the under side of the upper deck beams.

Jute charterers stipulate that "The ship's hold or holds to be efficiently ventilated throughout, by ventilators so constructed that they can be

kept open in all weathers (unless under exceptional circumstances). All ventilators to be kept in good working order. In stowing cargo special care to be taken that no obstruction of any kind is allowed to interfere with the efficiency of any of the ventilators. The master to afford all facilities to charterers and/or consignees, and/or their agents, to survey the vessel at all times, and to allow them free access to the hold during loading and discharging, for the purpose of inspecting the dunnage and ventilation.

"No mats to be used between the cargo and dunnage on ship's sides, nor on top of bales next upper deck. The cargo to be otherwise properly dunnaged. Bamboos, sticks, or rickers to be used as dunnage on top tier, to prevent bales coming in contact with under side of upper deck beams."

Jute shippers also recommend :—

1. That there shall be at least six ventilators of not less than 18 inches diameter, elevated 7 to 8 feet above the main deck, continued by Venetian shafts through the 'tween decks into the hold, with an air space under both decks of not less than 3 inches—fore and aft the vessel—these ventilators being placed at equal distances between the fore and aft hatches.

2. That two strong ventilators, about 3 feet high and 15 inches diameter, be fitted with screw covers in the main hatch.

3. That one of each of the hatches is to be kept open during the voyage, when the weather permits.

4. That the hatches are not to be filled close up with jute, but an air space left all round the combings.

5. That the spaces between the vessel's frames adjoining the lower deck are to be kept open, to allow the steam to ascend from the lower hold.

6. That the ventilators are to be carefully attended to at sea. Also,

1. That the old plan of sweat boards, formerly fitted under the stringer plates of the upper deck, would be very beneficial to a jute cargo, by carrying off much of the condensed sweat, also forming an air space where most required.

2. That matting round the sides be discontinued, as mats get saturated and retain the sweat ; dry sticks or permanent dunnage being preferable, allowing it to escape.

3. That no bone meal or broken stowage be carried with jute cargoes.

## ORE CARGOES.

The carriage of ore cargoes from the Mediterranean ports, and Bilbao to Britain, and other Continental ports situated in the North Sea, amounts annually to many millions of tons, the port of Bilbao alone at the present time contributing annually three million tons itself to the gross amount. These cargoes are stowed without any trunks being fitted in the vessel.

We will take a steamer with four separate holds, viz., two aft and two forward. as an example. Fill the No. 2 hold as full as you can.

trim it on the after part, and taper off the skirting of the ore in the middle of No. 1 hold, so that the ore lies in the ship forward in the shape of a gun coin or wedge, thick end aft. The after part of the ship must be trimmed in the same way, beginning by filling No. 3 hold in the fore part as high as possible, and taper the skirting of the ore off to nothing in No. 4 hold. As a rule most ore carriers take very little ore to trim them into sea-going trim in the No. 4 hold.

The object to be aimed at is to keep the weight well up in the ship. The higher the ore lies in the centre of the vessel the less she will roll in bad weather with a beam sea, and the more taper the ore has at the ends of her the more sea-kindly she will be in a heavy head sea, or running before a strong gale.

The general rule in loading a cargo of iron ore is to run up the No. 2 hold, then load No. 3 hold, and trim the vessel for sea with the No. 1 and No. 4 hold. These directions mean with steamers that are tanked throughout their holds; but even in a vessel with no water ballast tanks in her fore holds, the ore must be kept as high on the after part of No. 2 hold as possible. But such a vessel would require no ore in the No. 1 hold. It was thought at one time that iron ore so carried, viz., with such an immense weight in the centre of the structure, would cause the vessels to strain themselves unduly in the bilges at the skirting of where the cargo reached in the fore and after holds, and in their upper works amidships. The past experience of the last twenty years with steamers in the iron ore trades has proved that weak vessels have been strained considerably in the above-mentioned places, but that fairly well-built vessels have carried their cargoes stowed thus with impunity, and have developed no signs of undue strain. This experience thus proves that a weak vessel is not adapted to carry iron ore cargoes, without they are fitted with a properly constructed trunk; and putting up a trunk on short voyages entails a sea of labour, so is not recommendable.

Heavy ore, such as copper, must be stowed in a properly fitted trunk that runs fore and aft the vessel, and securely shored to the sides. These trunks are fitted so as to keep the ore as high up in the ship as possible, and on long voyages especially they are indispensable.

A cargo of Bilbao iron ore, if shipped in a very wet state, will absorb three per cent. of moisture, so it is very detrimental to a vessel's interests, in a pecuniary point of view, to ship it in wet weather, for the great bulk of the mineral, lying close to the engine and boiler-room bulkheads, dries up very considerably on a long passage, sometimes to the tune of 5 per cent., if it has been shipped very wet.

There are some descriptions of sulphur ore, such as is shipped in

the port of Huelva, in Spain, that undergo a process of kiln drying. If this operation is not successfully accomplished, the ore is liable to fire, and as it contains a heavy percentage of sulphuric acid, once the mineral has fired, water will not quench it, and may cause the loss of the vessel. The writer once, many years ago, was coming from Huelva, bound to the river Tyne with a cargo of mineral. In the No. 1 hold was placed 160 tons of such mineral described as above. When nearing our destination off Flamborough Head this 160 tons was discovered to be a mass of fire. Water was freely poured down on it, with the effect that it kept the ship's deck and upper works from breaking into a blaze, and placed a dark crust over the mineral on fire. But that was all, it did not quench the fire.

The mineral was afterwards discharged on fire into iron lighters, and burnt itself out on shore. Unfortunately for the vessel, the water poured down on the mineral had circulated through her ballast tanks to the engine-room, where it was pumped out by the donkey ballast pump. This water, being highly charged with sulphuric acid, attacked all iron with which it came in contact, the result being that chemical action took place in all iron in the ship's bottom unprotected by cement, and caused serious deterioration to many of her plates, floors, and tank divisions, which cost a round sum of money to replace. Therefore, before any vessel ships kiln-dried mineral of the above description, fire should be warily guarded against. Whole cargoes of such mineral are seldom shipped, and when packages of it are carried it should be bedded on other mineral, and isolated from the sides of the vessel. This mineral is shipped in small bags containing about 100 lbs. each.

Many sailing vessels, lured by an offer of a high rate of freight, engage a cargo of iron ore for a long passage, and rig an impromptu trunk with empty casks. This is a most dangerous expedient to resort to, and has often been the cause of the loss of the vessel, by the casks giving way during heavy weather; so the master of a sailing ship should not take in a cargo of ore unless he can see his way clear to build up a substantial wooden trunk, and well secure it by shores to the sides of his vessel, fore and aft, so that they cannot work out in a sea-way.

## WOOD CARGOES.

The principal provisions of the Merchant Shipping Act relating to carrying wood cargoes on deck are as follows:—

Between the last day of October and the sixteenth day of April, vessels must not arrive in the United Kingdom with

(*a*) Any square, round, wany, or other timber, or any pitch-pine, mahogany, oak, teak, or other heavy wood goods whatever, or

(*b*) Any more than five spare spars or store spars, whether or not made, dressed, and finally prepared for use, or

(*c*) Any deals, battens, or other light wood goods* of any description to a height exceeding 3 feet above the deck.

The master, and also the owner if he is privy to the offence, shall be liable to a penalty of not exceeding £5 for every 100 cubic feet of goods carried contrary to the Act.

Wood cargoes are stowed so differently by stevedores and seamen that it is impossible to give any hard and fast rules. However, we will place before the junior members of the profession a few remarks on the manner these cargoes are generally stowed in the Baltic trade, which will be a good criterion to go by for other timber ports.

In the summer months, in the limits above mentioned, deck cargoes may be carried as high as is compatible with safety to the ship, and this point is only arrived at by the captain, from former experience in the vessel, or by rule of thumb. Great difference of opinion, we are sorry to say, exists amongst shipmasters in this respect. Some masters often come home from the Gulf of Finland with deck loads of deals piled up 11 feet in height above their main deck, and the cargo levelled to this height fore and aft, whilst other masters, if they were placed in these vessels, would consider 6 feet a sufficient deck load.

There can be no doubt at the present time that deck loads, from the Baltic ports especially, are carried far too high for safe navigation. It is all very well to pile up the vessel's deck 10 or 11 feet high with deals, if they are well secured with 'thwart ship planks on top, *provided fine weather could be insured;* but in the North Sea in the early spring, or late in the autumn, westerly gales of great severity are frequently met with, and every year timber-laden vessels help materially to swell up the Wreck Register.

A steamer with a long well-deck may, with average safety, if she is a stiff vessel, carry 6 feet of deals upon the well-deck, and levelled off to that height fore and aft, if the ship is stable with that amount.

As regards the mode of stowing deals in the holds little can be said, any further than that they should all be stowed fore and aft, and as many got into the hold as possible. The deck load must be *carefully* stowed, and no deals must be placed inside the vessel's iron bulwark stanchions, as that space must be reserved for a clear water course. Great care must also be taken in placing the uprights on the after

* Light wood goods of poplar *other* than deals and battens may be carried, provided that no piece exceeds 8 cubic feet, and light fir goods also with a limit of 7 cubic feet. No logs are allowed in winter which are more than 8 in. in diameter, or 24 in. in circumference.

deck, so that if the after deck load was to shift a little by heavy rolling, &c., it would not jamb the wheel chains. These chains must be an officer's *first consideration* in stowing a deck load, for in going up narrow rivers, or amongst any heavy coasting traffic, if anything about the deck load was to jamb the wheel chains for a *few seconds*, it might mean the loss of the vessel; therefore too great care cannot be displayed in this respect by the officer in charge. Stevedore's workmen, as a rule, think little about the wheel chains, and care less, so that for the ship's safety it behoves an officer to be very vigilant when the after uprights are placed, and see that their heels are so secured that they cannot work in towards the bulwarks. The evil is easily avoided when placing the uprights; but once the deck load is on board, it is impossible to rectify the evil without unshipping half of the after deck load.

Also be careful, before commencing to place the uprights fore and aft, that small chains are passed round the heads of the bulwark stanchions here and there, according to the length of the deals, and hung down over the side, as it is a matter of difficulty—in fact, in some vessels an impossibility—to pass these chains after the deck load is on board.*

When the deck load is all on board, planks or deals doubled are laid on top, of sufficient length to reach right athwart the vessel from side to side. The chains previously spoken of are taken over the ends of these planks, made fast, and securely wedged; this prevents the deck load lifting if water comes on deck. And remember the more 'thwartship planks you place in this position, the better will the deck load be able to stand bad weather. Also, before commencing to take in the deck load, unship all the hold ventilators, plug them securely up, and cover them with canvas, and see the hatches are well secured with tarpaulins when the holds are finished loading, and all running gear coiled up in the rigging fairleaders; then finish off by placing rickers, poles, or life-lines fore and aft the vessel, from rigging to rigging, along her sides, and seize a temporary pin rail well up in each rigging to belay and work all the running gear.

You must also endeavour to stow the cargo on deck so that the steam winches can work transporting lines, through leading blocks

* S.S. *Hesleyside* (Board of Trade inquiry into loss of second mate through cargo breaking adrift) —steamer with deck load of deals. It was admitted, in evidence, that in securing the after deck load they were unable to fasten the lashings to the iron stanchions, because they had not taken the precaution to place these lashings in position before the cargo was received. The vessel herself was nearly lost.

placed well up above the level of the winches. If this part of the work is neglected, when entering docks, or mooring at wharves, &c., at the discharging port, very great inconvenience will be felt, and entail a great amount of hand labour on the crew which might have been avoided.*

As regards the carriage of sleepers from the Baltic ports, it is considered not safe to carry them above the main rail on the well deck, and on the raised deck aft (if she has one) 3 heights of sleepers is amply sufficient. Of course a vessel's stability *must* be taken into consideration; low vessels of great beam will carry a deck load with impunity that would perhaps capsize a much larger vessel of great depth and little beam. A good criterion to go by as to how a vessel will act with her deck load at sea, is—Take notice when heaving up a heavy sling of sleepers by your main winch, with the cargo derrick guyed well over the side (the general mode of taking in a cargo of sleepers up the Baltic). If she lists much when the sling comes clear of the water, *after the holds are full of cargo,* you may conclude she is going to be tolerably crank, so ease the deck load accordingly; but if she pays no attention to the weight of sleepers hung to the derrick-end, you may conclude she is stiff, and can therefore take in a deck load as advised above.

This, of course, is only a rough guide to go by; nevertheless many experienced stevedores up the Baltic are considerably influenced by the above experiment as to a vessel's merits in carrying a deck load.

If you have imprudently taken in too heavy a deck load of sleepers, it will be necessary to run in a great portion, if not all, of your water ballast to stiffen her. If such is the case, the ship will be down in the water as deep as her disc, and if you chance to fall in with heavy weather she is very apt to float the deck load, which might be the cause of the loss of the vessel, by the heavy sleepers, when afloat, driving in some of her transverse bulkheads.

If you should be so unfortunately situated, prevention is better than cure. Immediately bad weather sets in, and she begins to ship heavy water, ease her down dead slow, and bring her head to sea, and keep her in that position, *if possible,* till the weather moderates. Gently nursing her is the only way out of the difficulty; for to try and secure a deck load of sleepers that has once got fairly adrift in a gale of wind is next to an impossibility.

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* Deck pumps and sounding pipes should also be left clear if possible.

NOTE.—In a Baltic charter, boards are 1½ inches or under in thickness. Scantlings are more than 1½ inches.

The means used to secure a deck load of sleepers is to frapp them down to the stanchion heads and eye-bolts around the deck with small chain. This is done to prevent the top sleepers getting rolled overboard in heavy weather; but to bind them down and secure them effectually, like deals are secured, is an impossibility, as they are not long enough in some cases to reach from stanchion to stanchion.

Great care must be exercised in the stowage of sleepers on deck that a clear water space is kept fore and aft the vessel inside of the bulwark stanchions; that the freeing ports are all clear, with the fasteners taken off them; and that the rudder chains or rods are secured from jamming, and have plenty of room to work freely.

A heavy deck-load of pit-props is not one of the best things to secure by any means, for you may frapp them down as you like, if water gets on deck they will become alive and float up between the chain frappings, and get into a confused mass, with the concomitant result that the best half of them generally go overboard. All other deck cargoes, such as staves, lathwood, &c., which are carried on deck, being in short lengths, no available means are at a seaman's disposal to secure them properly if once they are floated. As long as ever the decks of a vessel can be kept clear of water, the chain frappings will prevent them getting adrift when the ship is rolling heavily, *but that is all;* so it behoves the officer of the watch to act promptly if bad weather sets in during his watch, in a vessel with such a deck-load, and call the master before she ships water enough to float the cargo, so that he, the master, can heave the vessel to and prevent an accident happening.

The shorter the lengths are of any wood carried on deck, the greater the vigilance is required of the officer in charge of the stowage in regard to keeping a free waterway to the freeing ports in the sides of the vessel, and *extra caution* is necessary to preserve the wheel chains from getting jammed.

Heavy timber, such as baulks for masts and yards of large ships, &c., that are brought by sailing ships to the United Kingdom on long over-sea voyages, such as teak timber from Moulmein, and other descriptions, such as pitch-pine, mahogany, fir, &c., from the American ports, require excessive care in their stowage. Every cuntline and vacant space ought to be filled up square with small timber, and each tier properly wedged, both in the sides and amidships from keel to deck, the top tier being securely wedged down below the upper deck beams. Vessels carrying teak timber, or, in fact, any kind of heavy wood, will sometimes not load themselves full in the holds, so they

require no deck-load; but in loading fir timber at the North American ports, deck-loads are permitted to be carried under certain limits during the summer months, as mentioned above.

When such is the case, great care is absolutely necessary in securing the deck-load, and every available eyebolt about the decks should be used to pass chain lashings through to secure the timber. Many seamen of the old school objected to chain lashings being used, alleging that in case of an emergency arising, where it would be necessary to get clear of the deck-load to save the vessel from foundering, that chains could not be cut in a hurry. But at the same time it must be borne in mind that a deck-load of heavy baulks cannot be secured so *effectually* with rope as they can with chain lashings; therefore the seaman who has great faith in his vessel's sea-going qualifications would be perfectly justified in using chain lashings, and making a good trustworthy job of the deck-load before he left port. Heavy logs of round timber are bad cargoes to stow, and, to make them at all secure, great quantities of small wood must be employed in their stowage, and large wedges used unsparingly.

## PILGRIM TRADE—NOTES.

AWNINGS.—Should be spread and carried throughout, weather permitting. Moorish pilgrims prefer deck accommodation, and yet feel the sun more than Easterns.

WATER.—The regulation allowance is one gallon per day per adult, but water is eagerly sought for, and a plentiful supply should be allowed. Upon no account should water be charged for by any of the crew.

PILGRIM FITTINGS.—Six or eight overside W.C.'s hung in chains from rigging on both sides fore and aft. Three wooden galleys about ten feet by four feet lined with tin or zinc, with fire brick and sand beds, are sufficient. These could be made by contract at Marseilles or by ship's carpenter. Tough strong work is necessary, but pilgrim fittings, if well made, will often bring their value in Jeddah, or can be used for several voyages. Two ladders, broad and strong, with hand rails, are necessary for each hatchway.

MEDICINES.—The ordinary ship's chest, with addition of disinfectant *powders*, not fluid, some cholera mixtures, &c., &c., are sufficient.

TICKETS.—The rates in francs should be filled in, in counterpart, body and duplicate; every ticket numbered consecutively. Agents retain counterpart; duplicates should be taken from pilgrims on coming aboard. Body of ticket should be collected from *all* pilgrims between Suez and Jeddah, and sent home to owners to be checked with agents' passenger lists. Very great care must be taken to prevent stowaways, to allow no one aboard without tickets. Captain and officers should trust no one, neither native clerks nor brokers, and especially guard against runners or touts on North African Coast. Captains and supercargoes responsible for any neglect in this way. Officers and crew should keep a good look-out; pilgrims

should come up gangway ladder and their baggage be hoisted up by winch and placed down holds (excepting food and necessaries for voyage). If it be known a steamer is very careful in examining tickets and preventing smugglers, &c, there will be fewer swindlers; but if a vessel has a name for carelessness, it is soon found out.

Discipline.—Great discretion is required in maintaining order on board; it is necessary to be very firm, but all harshness must be avoided, and on no account must anything be done to shock the religious feelings of the pilgrims. Mutinies have arisen simply from want of judgment on the part of those in charge.

Passenger Lists and Accounts.—In detail should be given by every agent to the commander, and copy sent to owner with ship's accounts.

Freights.—Less approximate disbursements and commissions, should be handed in cash to captain before sailing, for remittance through Canal agents (Port Said). There may be some loss of exchange and some delay in this, but it is safer, and agents at outports are not well known. Remittances can be made by Telegraphic Exchange, for Egypt.

Bills of Health.—Should be carefully seen to from each port.

Gratuities.—To port officers, &c., are necessary in a reasonable, moderate way, but not lavishly nor indiscriminately.

## SLINGING HORSES AND CATTLE.

The carriage of cattle is regulated by specific laws, which will of course be obtained from the proper authorities.

In taking in horses out of lighters, great care is absolutely necessary in properly slinging them, for the moment a restive horse feels himself being risen off his legs, he commences to kick violently, and if he is not properly slung is very apt to kick himself out of the slings and come down by the run, which would probably mean a broken leg. To obviate this difficulty a *proper horse sling* is made (*see Plate No. 115*), out of which the most restive horse cannot possibly kick himself.

In sailing ships the plan usually adopted in taking in horses out of lighters, is a stout single luff-purchase hooked on to the main yard, so as to plumb 6 feet outside the main rail, the yard being secured and canted a little forward by the braces; a span from the fore and main topmast head being fitted with a double whip purchase, for lowering the horse down to the required place after he is run up high enough by the yard tackle for his legs to clear the main rail.

In taking in horses on board of a steamer, a single purchase chain and derrick is used, no 'midship purchase being necessary.

Very valuable horses, such as prize race-horses, are generally sent alongside in a narrow horse-box; when such is the case, the best plan

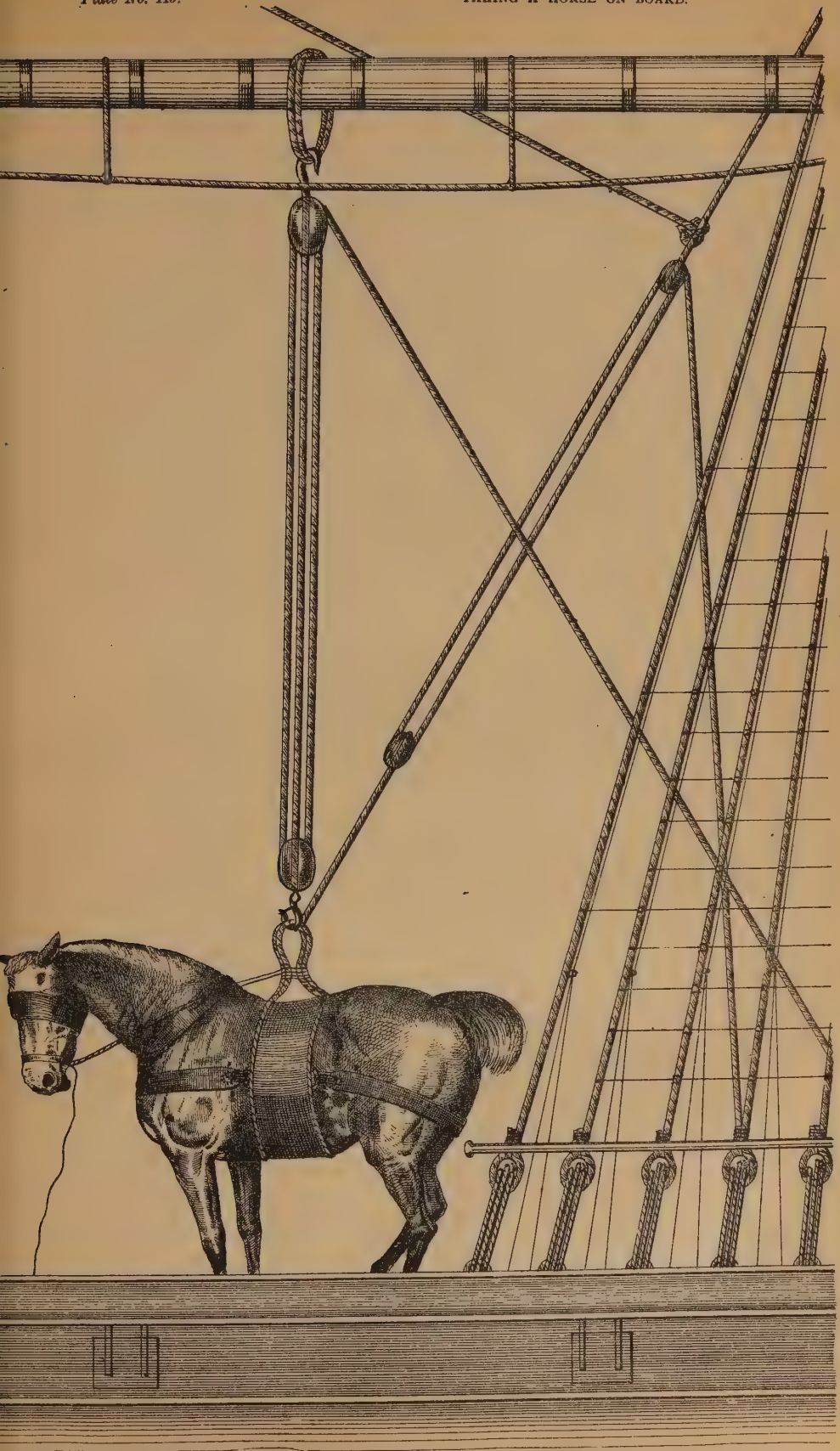
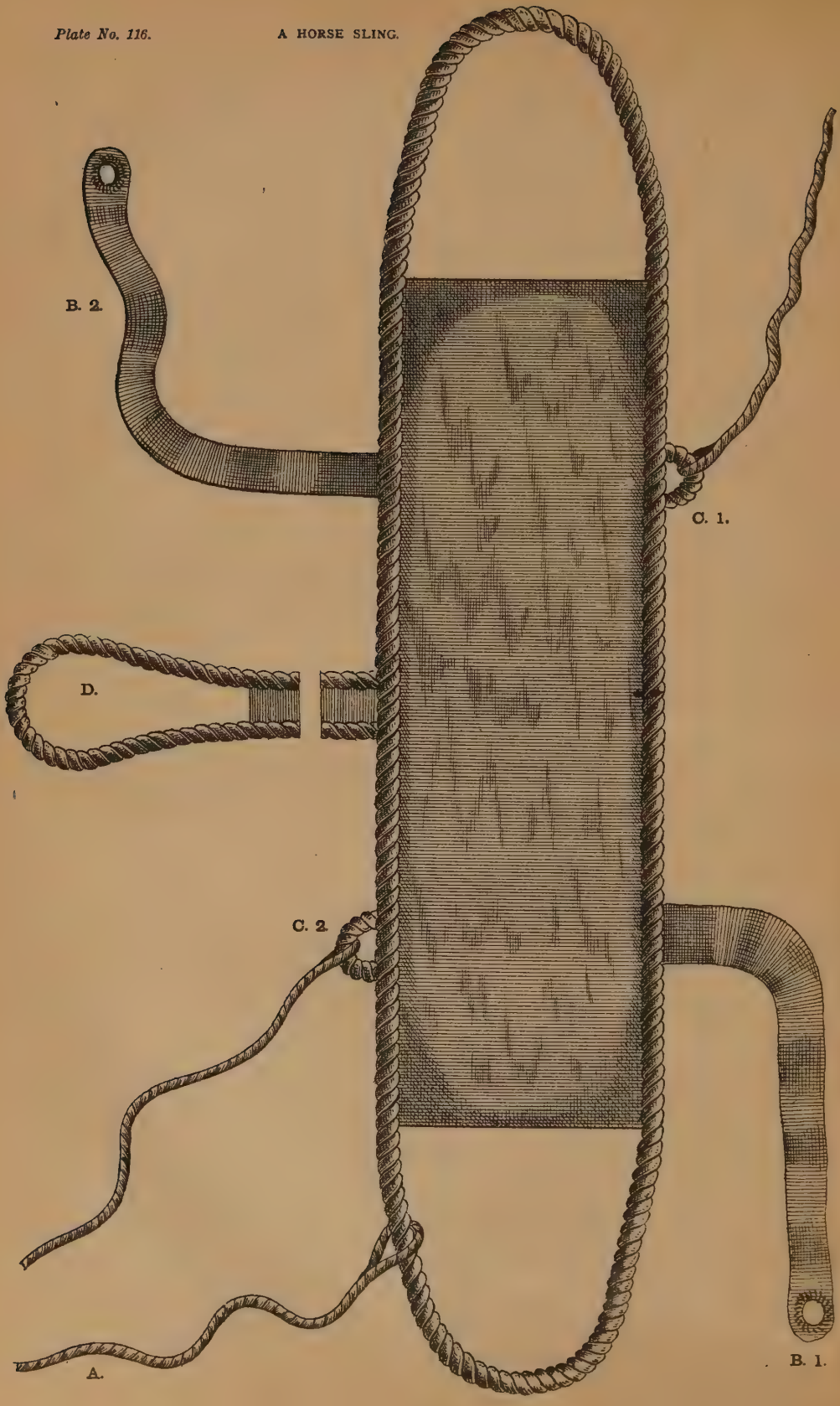


*Plate No. 116.* A HORSE SLING.



is to secure the horse in the box, and sling the box, heaving horse and box up together.

New Zealand cattle are generally taken in slung by the horns alone. A common rope strop, parcelled, being placed round the root of the horns, a strong whip purchase is hooked on to it, and the cattle whipped smartly on board by the aid of two horses on the fall.

Yet there are cattle that cannot be slung in this manner: when such is the case a cattle-sling must be constructed, as described below, with the exception that it requires no martingale or quarter bands, as there is no danger of a bullock kicking itself clear of a sling.

To construct a proper horse sling proceed thus:—Take the measurement of a large horse round the centre of its body, and cut a piece of No. 1 canvas, of sufficient length when doubled to go three-quarters round the girth of the animal. Along each selvage side of the canvas rope on strongly a piece of good 3-inch bolt-rope, so that a bight will be formed at each end of the canvas of about 2 feet 6 inches in length, and splice the ends of the bolt-rope together (*see Plate No. 116*). Round one of these bights splice a piece of ratlin line a fathom long, marked *A* in the accompanying plate, called a frapping lanyard. Next stitch securely on the sling two bands of double canvas 6 inches broad, with a large eyelet-hole worked in their extremities, of sufficient length to reach round the breast and hind-quarters of the horse respectively, marked *B1* and *B2* in the plate. These bands are secured to the cringles marked *C1* and *C2* with lanyards, and are for the purpose of preventing the horse kicking itself out of the sling.

On one side of the sling, no matter which, is securely sewn in its centre another band, 6 inches broad, of double canvas, and roped along its edges, the rope being carried upwards to form a bight of sufficient strength to go over the head and neck of the horse; its use being to prevent him from flinging his head up, and at the same time it helps to keep the sling in its proper position. This is marked *D* in the plate, and is termed the martingale band.

When placing the sling on the horse, pass the end *D* from underneath its body through between its fore legs, and over its head; then adjust the sling round the belly of the horse, and bring the bights of the sling together above his back, frapping them tight together with the lanyard marked *A* in the plate. Now take the bands *B1*

and *B2* round the fore and hind quarters respectively, and secure them by their lanyards to the cringles in the sling marked *C1* and *C2*. Also make a rope fast to the horse's halter to act as a steadying line, then blindfold the horse, hook on your purchase, and run him smartly up.

It repays an officer doubly over for the little extra time and trouble it may have cost him to make such a sling, especially so if there are many horses to be taken on board, for once this description of sling is properly placed on a horse it is impossible for him to come to grief by kicking himself clear of the sling.

The writer, many years ago, whilst a junior officer on board of an East Indiaman, was employed taking in a valuable horse in Singapore roads with an impromptu sling. The animal became very violent, and when he was well up, nearly as high as the topgallant rail, he kicked himself clear of the sling, and fell on the lighter's gunwale, breaking both his fore legs. The result of the accident was the horse had to be shot, and the ship had to pay £120 to its master.

Valuable animals should stand athwartships during the voyage, the sides and ends of their boxes should be padded, and they should be slung. The slings should be secured at such a height as to hang about 6 inches below their bellies when they are standing up. When the vessel begins to roll the animal soon finds the good of the sling, settles itself down into it, and rolls with the ship.

## FINAL REMARKS ON LOADING.

The question of the depth to which a vessel may be loaded is now settled. The old rule of 3 inches to the foot of hold is now out of date. Every British ship (except vessels of less than 80 tons register employed solely in the coasting trade) must have their freeboard marked on their sides. Such freeboard can be obtained from the Board of Trade, "Lloyd's," the Bureau Veritas, or the British Corporation, and no vessel may be laden beyond her load-line in salt water. These marks are placed amidships on the water line, and give freeboards for Indian summer, Ordinary summer, Winter, and North Atlantic winter, with a further mark giving difference between loading in fresh and salt water. The position of each deck above these load-lines must be indicated by a line 12 inches long by 1 inch broad, the upper edge of which should be level with the upper edge of the deck plank next to the waterway. (It must be remembered that these marks, unless assigned by one of the aforementioned

ladies, are no guarantee that the vessel is not overladen, if loaded to such marks). Other countries are now adopting an official load-line.

Roughly, an ordinary well-decker will require $1\frac{1}{2}$ inches to the foot of hold; a flush-deck steamer with bridge, poop, and forecastle 2 inches to the foot of hold; an ordinary iron sailing-ship about $2\frac{1}{2}$ or $2\frac{3}{4}$ inches to the foot. But each vessel, whatever her construction and dimensions may be, is judged on her own merits, and an exact, sufficient freeboard can only be arrived at by one fully conversant with the subject, and with the Tables at present in use.

Masters loading a heavy cargo, such as iron ore, are sometimes puzzled by finding that their fore and aft draught does not correspond as usual to the freeboard amidships. The reason of this is that the ship has sagged, and weak vessels loading these cargoes will be liable to leak at the butts on the turn of the bilge at the fore and after ends of the bulk of cargo.

If with a crank ship under foot, and loaded with grain or similar cargo, never neglect the first sign of a list, and bring the sea on the other side till she is trimmed up. The 'thwartship bunker in such a vessel wants watching, as well as the holds, to see that it is evenly trimmed; and the chief engineer should be cautioned as to the great importance of seeing that this is rigidly carried out. If there is a 'tween deck laid in the bunker, no coal whatever should be allowed in it when there is room for it in the lower bunker; and if the 'thwartship bunker is very large, it would be far better to have a 'midship partition in it.

Great care is also necessary to see that bunker hatches *are kept battened down* securely in bad weather. Firemen, if allowed, will have them off, and never think of putting them on again; whilst if told to batten them down they would probably think themselves ill-used.

The important things, then, to be observed with a crank ship and a cargo likely to shift are:—First, in all grain ships, shifting boards from deck to ceiling, filled in between the beams; full and sufficient feeders to the hold; and, secondly, square and fully secured work in the 'tween decks, with shifting boards. Then on the voyage, as soon as ever there is room, have 'tween deck bunkers trimmed down, and carefully watch the first symptoms of a list.

Vessels which are in a mixed cargo trade should also be carefully

stowed. Such things as casks of grease, palm oil, honey, or molasses should not be allowed in the 'tween decks. And such tricks as stowing bales or dry cases on grain in bulk in a half filled hold, with nothing between the two, should not be permitted. All these things have been done, and in many cases have resulted in damage, and in some cases in the loss of the vessel, or loss of life.

There are occasions when these things are done without the owner's knowledge. So much power is placed in these days in the hands of clerks and agents, who are often but office boys; stuff comes down late; some irresponsible youth says it *must* come in; the master fears to refuse in case of reprimand, and the mischief is allowed to be done. The master, or in his absence the mate, should remember that the real responsibility rests with them. It is often the same way abroad in the matter of preparing a ship for a grain cargo. The master wants to save expense in these close sailing times, and allows the cargo to come into a vessel only partly prepared to receive it.

All intelligent shipmasters are well aware that a vessel's behaviour at sea depends greatly on the way she is stowed: that it does not always follow that, because a vessel is tender, she is therefore dangerously "crank;" and that it is often advisable in a very stiff ship to raise the weight in her, to make her sea-kindly. But it is to be feared that in these days of hurry these matters do not, in general, receive the attention they should do. Young seamen should acquire a habit of looking into these matters whilst officers, that when they get command they may in some measure feel and act up to their responsibilities in this direction.

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## SECTION XXXI.

## TO GET OUT A HEAVY WEIGHT.

It often happens in these days that a steamer has a very heavy weight shipped, such as a boiler or a steam launch, which is taken *in* easily enough under sheers or a crane, but which may in the foreign port have to be discharged by the vessel's own gear, and possibly in an open roadstead.

Now in such cases great foresight and care are necessary to guard against a mishap, and the hints here given will, it is hoped, assist the young mate in making the best preparations for such an event. Sailing vessels sometimes have similar weights to discharge, but, as a rule,

Hook for cargo work. The guard A. prevents the hook catching coamings, &c., when heaving up.

they are better equipped for the work than a steamer; so in the first place we will endeavour to provide for the steamer's case, and afterwards give the necessary additional hints as to procedure in a sailing vessel.

Firstly, then, the weight will, as a rule, be stowed in the No. 2 hold, *i.e.* between the boilers and the foremast. Now, in this place it will be difficult to make *much* use of the fore-yard, and besides, steamers' yards are usually too slight for the work.

If the vessel is large the fore-boom may sometimes be utilized, but it depends on its size. Supposing you are fortunate enough to have a fore-boom anywhere near the size of a 1,400 ton ship's driver-boom, old style, namely, of 13 or 14 inches diameter, this would (with the addition hereafter mentioned) be available. But if not possessed of a proper spar, one must be shipped at home for the purpose. Purchase blocks must also be provided, for though up to a weight of 6 or 7 tons the cat and fish blocks would serve, for weights beyond this the ordinary anchor gear of a steamer is not fit; and we are talking now of such weights as 15 to 25 tons or more.

Now suppose a fairly good spar and purchase blocks are in your possession, proper falls and slings will next be required.

If you can possibly avoid it do not take second-class rope; fairly good manila *can* be got in England if it is paid for, and for a purpose of this kind it *pays* to get good rope.

Americans invariably do work with smaller rope and lighter blocks than we do, for the simple reason that they work with better materials. The writer has seen a wrecking vessel at Bermuda discharging blocks of marble of from 8 to 10 tons and over, with a threefold purchase rove of 3-inch manila, but the blocks were large and well finished, and the rope like silk, all pure, long manila fibre, without any mixture of jute or worse trash. If second-rate rope is used, the performance will not be so satisfactory, and all the best of the strength will be out of the rope after it is over; whereas with first-rate rope you can use a size of $\frac{1}{4}$ or $\frac{1}{2}$ inch less, which will run freer in the blocks, and will be good for other purposes afterwards.*

If using rope slings, or lashings, be sure and have *plenty* of parts, so that no accident can happen there. But if using chain for slings (or

* Unlay a yarn of rope, and, if good manila, the stuff will be shiny and silky, and the fibre will be over a foot long, on an average, and parts of it longer. Inferior rope will appear to be composed of duller, dirtier stuff, and the fibre will be short, perhaps eight inches and less. Good rope is soft and pliable; poor rope hard and stiff to handle, and bristling all over with short ends.

indeed for any other part of the gear) be sure of what you are using. In the first place, it should be tested chain, and not more than slightly worn, and if it has been in use (such as a winch chain) it should all go through the fire first. Winch chain, or any other, when long in use gets brittle, and unless treated this way occasionally, is not trustworthy, however good the make may be.

We will now suppose you are all right for gear, and proceed to rig it for the purpose of getting the weight out.

If using the fore or main boom, it will be wise to unship the gooseneck and let the heel of it rest in a wooden shoe in the deck, and lash it securely in this position. But if resolved to use it (derrick fashion) where it is, then the gooseneck which connects it to the mast must be very strongly shored up from the deck, and also between the boom eye and the mast, to ease the strain on the iron work. (If you have a spar for a derrick, of course it will rest in a shoe on the deck.)

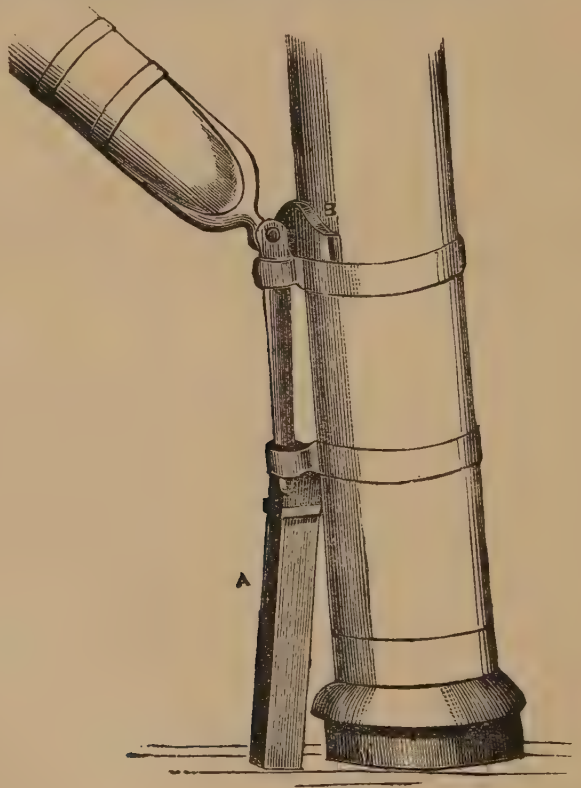



*Plate No. 117.*

*A.* Shore for lower end.
*B.* Chock to help the gooseneck.

Before commencing to rig this derrick, take a smaller spar, such as a gaff or a fore-hatch derrick, and lash it on to the middle of the derrick, so that it will lie on the back, or upper side, when the derrick is up in position; it thus answers the purpose of a fish, and gives the main spar greater strength. Tauten up these lashings with wedges, so that as far as possible the two make one spar. Now proceed to rig the derrick in the usual manner. If necessary, fasten cleats or shoulders to the upper end, to prevent the guys and purchase block from working down. (Sometimes these boom derricks have span and guys shackled to the end, whilst the winch chain gin is hooked some feet down the boom; this is all very well for ordinary cargo work, but in *this* case the purchase block must be lashed to the same place at which the guy is secured.) *(Plate No. 118.)*

Besides the ordinary span, put *heavy* preventers, either of rope or chain, on as well, lead these up and secure them to the lower masthead, being sure they all take a strain, and fit preventer stays to both foremast and topmast (unless you are heavily rigged.)

Now reeve the purchase, so that the hauling part comes in the lower block, then reeve this part in a leading block lashed below the after-part of the top, and bring it down to the winch. By reeving thus you get a great increase of power (which means easier and smoother working), and part of the strain is taken off the derrick head.*

Lash this purchase to the derrick head, being sure you have plenty of turns, and before finally securing it take a strain on the purchase, to make sure that all parts have the strain.

A strong guy must now be fitted to the derrick-head, and be led down to the deck on the opposite side to that on which the weight is going out. (A guy will be wanted the other side, unless the ship is perfectly steady, but this need not be so strong.) A secure place must be found to hook this guy to, which will bear the strain. Sometimes a bollard can be utilized for this purpose, but if no other means are available, a long strop made of the stream chain may be passed round the ship's bottom, and up through a warping chock, or mooring pipe. On no account trust to an ordinary ring bolt for this purpose, and be sure this guy is sufficiently strong in all parts, and can be slacked away smoothly.

Now if you have no other spar fit for lowering or hauling out derrick, take your two wire cargo spans and lash them to the topmast

* The hauling part should come in the second sheave of the block, not the outside one, so that the great strain on that part may not cant the block in the strop. This will involve a cross in the parts of the fall.

head, getting all the turns of the lashing that the eyes will hold, and being careful that the bottom ends of the spans come an equal length. (If one span is much longer than the other a round turn may be taken with it at the masthead.) Reeve off a full new fall in the best of your cat and fish blocks (having first sighted the pins), and shackle on this purchase to the spans; mind and reeve this as the main purchase, that is, so that the hauling part is in the lower block. This part must be led up through a block at the topmast head, if possible, down to the fore winch. Shackle on another span if you have it (or two parts of a wire hawser will do) to the eyes of the span carrying the purchase, lead it along aft outside all, and in through the after hawse pipes; with this haul the pennant aft till the purchase plumbs the hatch. Brace the fore yard sharp up on the opposite tack to the side the weight is coming out, and lead a good tackle from the pennants just above the purchase block to the fore yard-arm, far enough out to clear the backstays, and haul out the pennant till the purchase hangs well clear of the side. Whilst heaving up out of the hatch this tackle need only be hauled out sufficiently to plumb the deck, thus giving the span purchase a fairer lead down the hatch; then, when the weight is over the coamings it may be landed handsomely on the deck skids, and the yard-arm tackle may then be hauled out sufficiently to get the weight clear of the side, but it must be remembered that this is only a *hauling out purchase*, and must only be used as such, never having more than a part of the full weight upon it.*

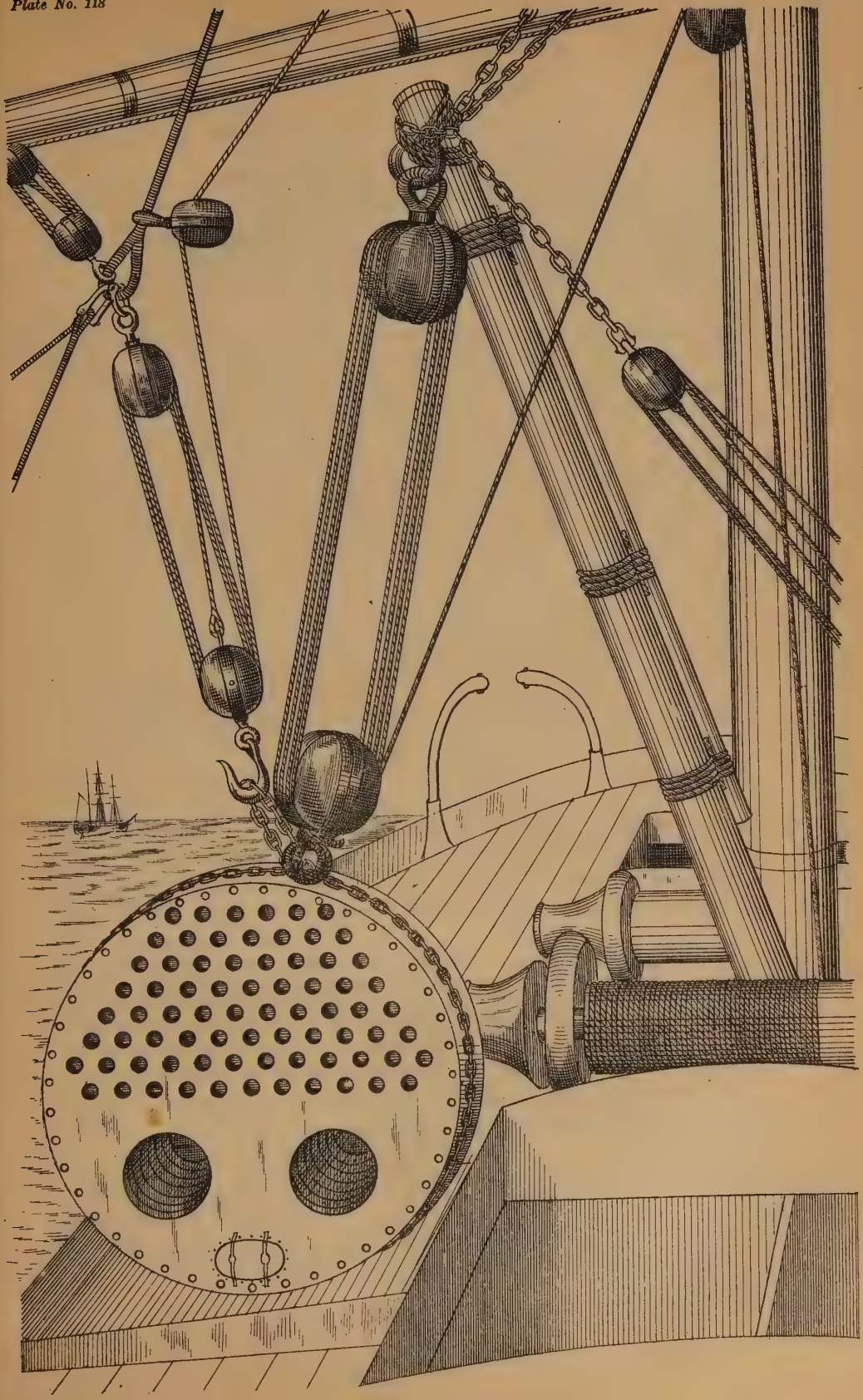
If you have no fore yard it will then be necessary to rig a second derrick for getting the weight clear of the side, with its heel resting close to the water-way, and with a good rake outwards. Of course if the main derrick can be swung sufficiently with safety this will not be necessary, but even if so, rig the span purchase all the same, to divide the strain and make things safer.

Now shore the deck up strongly below the derricks, overhaul both purchases down the hatch, and lash both the lower blocks to the thing you have to lift, being careful that blocks lie fair, *and clear each other when the strain comes on them.*

Now see that the main derrick fairly plumbs the centre of the hatch, so that the weight will come up fair, then haul taut and belay the opposite guy. See that the span tackle is hauled far enough aft, so that it does not bring the tackle too far forward when the strain comes on it.

* Bowsing out spars are sometimes rigged for getting a weight clear of the side. These are outriggers securely lashed at the inboard end, the heels resting against the hatch coamings, with strong tackles at the outer ends for hauling the weights clear of the side whilst hanging in the main purchase.

*Plate No. 118*



If you have no deck skids, protect the deck with some planks, in case it may be necessary to land the weight, and build these up to slope a little from the coaming to the side; the slope must only be slight. Protect the side the same way, that there may be no danger of catching on the edge of the sheer-strake, or a lower plate edge, when lowering away.

All is now ready. Be sure the lighter is fit to receive the weight, and do not attempt the job if the vessel is rolling. Better wait for a week than do this, unless you can put a spring on the cable and spring-head on to the swell. Have a good *clear* lead for each fall to the *mid-ship* barrel of the two winches; do not hold them on to the outer barrels. If the fall is long enough to go down into the hold, it will be long enough to land the weight in the lighter. Have your two best winch men for the job, and put both winches into double purchase. Take a position where both drivers can see you. "Heave away!" and when high enough guy carefully over the side; lower away both together by reversing the winches (not throwing them out of gear and trusting solely to the breaks). Do not land the weight until fair in the lighter; and, above all, throughout the whole operation avoid hurry, flurry, and shouting.*

It is well to slack the main derrick over no further than necessary.

Remember that the more up and down the derrick is the better, as more strain comes on the heel, and less on the span, so do not droop it more than is sufficient to clear the weight of the fore part of the hatch. (If the backstays are in the road, they can easily be come up for the time.) Remember also, especially in lowering, that the smoother everything goes the less will be the strain on all the gear and the masts. *Rough surging will increase the strain greatly, and be extremely likely to carry something away.*

A sailing ship being always better off in the way of spars than a steamer, can generally rig derricks or sheers fit to discharge almost any weight. The usual way in such a vessel is as follows:—

The weight will be in the main hatch, just forward of the mainmast.

For the heaving up purchase, take the spare topmast, and rig it as a derrick over the main hatch just abaft, with good guys from the derrick head to fore and main mastheads, lash the main purchase to the head of it as strongly as possible. The heel must rest over a beam in a wooden shoe on the deck (which must be shored up from below), and lashed securely in its place.

*When the weight is up above the coamings do not lift it any higher, but let it just touch the deck skids all the time you are heaving it over the side, then if anything starts it will land at once.

For the lowering purchase proceed thus:—Haul the mainyard forward a little, and top it well up; if necessary, untruss it, and cross-lash it to the mast, and this will be generally wise, but use plenty of chafing gear between the two under the lashing if your spars are wood; then lash another good spar as a derrick to the *after part* of the yard, slightly outside of where it plumbs the rail. See that the heel rests on a beam,* and have a good wooden shoe under it; now lash it securely in its place; then pass about four turns of your towing hawser round the lower masthead and yard, a little outside the derrick, frap all parts together, and then slack up the main lift. (If thought advisable, the last part of the hawser may be led over the masthead and down to the deck, on the opposite side, and made fast securely.) Lash on the purchase block round the derrick head, letting it hang below and on the *fore side* of the yard, and reeve your purchase. The rest of the proceeding will be similar to the method in a steamer, except that as there are no steam winches, the windlass must be utilized. The main purchase must be led there, and the other to the after capstan. When lowering, it may be perhaps best to slack away the turns of the main purchase round the windlass, but it will be wiser not to attempt this with the other fall, but stooper it off, take it off the capstan and lower it round a large cleat if you have one; or lash a round fender between two bollard heads, and lower it round this. Be careful the falls do not catch fire, and be sure to ease both together, and with as little surging as possible.

If your vessel is small, and her spars only slight, remember that the thing to be aimed at is to place all the strain possible on the derricks, and to use the mainyard only as an out-rigger. In such a case it is absolutely necessary to untruss the yard, and it will be wise also to put a tackle on to the lower yard-arm (or that opposite to the derrick), and lead it to the masthead as an extra support to the yard.

Derricks and gear cannot be too strong, and may be too weak; it is better to err on the right side.† With a four-fold purchase, lowering by hand is a much easier and smoother process than with only three-fold blocks.

Overhaul all the gear to be used *yourself*, and see there are no weak places, no worn shackle-pins, &c. Have the pins of the purchase blocks out, to see *they* are all right.

* All derricks with their heels resting on the deck must be over a beam, and in addition shores should be used beneath.

† It must be remembered that the usual wire spans in a steamer's outfit are seldom larger than 3 inches. Now best new *steel* wire of this size breaks at 18 to 20 tons. Chain spans are seldom larger than 1-in. chain, and this tests to 18 tons, breaks at 27 tons. New and first-rate good 7-in. rope is equal, roughly, to 3-in. common wire, breaking at about 15 tons.

Care and thought pay for themselves in matters of this kind, and though recklessness is often found in smart seaman, it is the careful, steady-going fellow who wins in the long run.

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## SECTION XXXII.

# NAUTICAL TERMS.

In this vocabulary the names of spars, rigging and running gear have—except in one or two cases—been omitted. Such names will be found under their proper headings in other parts of this book. It is founded on the lists of Smythe and Dana, more particularly the former, whose admirable "Word Book" is still the recognised authority. A few obsolete terms have been omitted; with these exceptions every effort has been made to make it complete.

A.B. Able-bodied. The rating of *Able Seaman.*

ABACK. The condition of ship's square sails when the wind is against their front surfaces.

ABACK, TAKEN. Brought aback by a shift of wind.
'All aback forward!' The notice given of this from the forecastle.

ABAFT. Behind, or aft of.

ABEAM. Abreast of. Opposite the centre of the vessel.

ABOARD. In or upon the vessel. To 'fall aboard of,' is to run foul of another vessel.

ABOUT. The condition of a ship after she has tacked. She is then 'about.'
'Ready about!' The preparatory order before tacking (page 104).

ABREAST. Side by side. Abreast of a place is exactly off it.

A-BURTON. Casks stowed athwartship are situated thus.

A-COCKBILL. The anchor is thus when hanging by its ring at the cat-head, ready for letting go. To top the yards by one lift is to cockbill them.

ADRIFT. Floating at random; broken from moorings. To cut adrift is to cut loose.

AFLOAT. Supported by the water, clear of the ground. In a secondary sense, being on board ship. 'I'm afloat!'

AFT. Short for Abaft. 'Right aft' is astern, in a line with the keel. 'To haul aft' (a sheet) is to pull it in the direction of the stern. The wind is usually said to '*haul*' aft, though *veer* is more correct.

AFTER (comparative). Opposite of 'fore,' as after-hatch, after-part. After-body is the shape of the after-part of the hull.

AGAINST THE SUN. To coil a rope from right to left. Only properly applying to the latitudes north of the sun. When the wind backs it is said to go 'against the sun.'

AGROUND. A ship whose bottom touches the ground. Opposite to 'afloat.'

AHEAD. Opposite to 'astern.' Anything in front of the ship or her course. Ahead of her reckoning means she has sailed further than was estimated. To 'get ahead of,' is to overhaul another vessel.

A-LEE. Opposite to 'a-weather.' The position of the helm when it is so put as to bring the ship's head to windward. 'Helm's a-lee!' the call, in tacking, when the helm is put 'down.'

ALL STANDING. Fully equipped. To be brought up all standing is to be suddenly checked or brought to a stop.

ALL. All-aback (see Aback). 'All hands,' the whole crew. 'All in the wind,' the sails all shaking. 'All gone!' the answer when the order 'let go' has been complied with.

ALOFT. Overhead. 'Up aloft,' anything or person high up on the yards or masts.

ALONGSIDE. Lying alongside. Any vessel or thing floating by the side of a vessel.

AMIDSHIPS. The middle part of a vessel. To put the helm amidships is to place it in a line with the keel.

ANCHOR-WATCH. The watch, usually one officer and one man, set when the ship is at anchor.

ANSWERS HER HELM. When a ship obeys the action of the rudder.

APEAK. The anchor is thus when the cable is hove short.

APRON. A canvas protection to the legs when heaving the hand lead.

ARM. To 'arm the lead,' is to apply tallow to the lower end, in order that a specimen of the bottom may be obtained. Arming, the tallow applied. Yard-arms, the extremities of the yards.

A-STARBOARD. The opposite to 'a-port.' The helm 'a-starboard' causes the vessel's head to move to port (page 29).

ASTERN. Behind a vessel. In the after part of a vessel. Opposite to ahead. To drop astern is to be left behind.

A-TAUNT-O. Fully rigged, sails bent, &c.

ATHWART. Across. Athwartships, from side to side. Opposite to fore and aft. Athwart hawse, anything drifted across the bows.

A-TRIP. The anchor when just broken out of the ground.

AVAST. Stop! Avast heaving! stop heaving, &c.

AWASH. A rock just level with the surface, the anchor just appearing when being hove up.

A-WEATHER. Opposite to a-lee. The helm put a-weather should cause the ship to move *away from* the wind.

AWEIGH. The anchor off the ground when heaving up, when you have the weight of it.

BACK. To back an anchor, to carry another anchor out ahead of the one the ship rides by, to take part of the strain. To back and fill is to work to windward with the tide in a narrow channel by short boards and backing. The wind backing, is going round against the sun.

BALANCE REEF. A reef making a trysail a three-cornered sail.

BALE, TO. To pass water out of a ship in buckets when the pumps are choked. To bale out a boat with a 'bailer.'

BALLAST. Weight of stone, pig-iron, &c., stowed in the hold to allow a ship to move safely when no cargo is aboard. 'Water' ballast, is water, confined in flat tanks built in the bottom of a vessel, for the same purpose. 'Ballast-trim,' a vessel with ballast only aboard is in ballast-trim.

BANK FIRES, TO. To so 'damp' a steamer's fires that they keep alight and ready for immediate service without waste of coal.

BAR. Of a port, an accumulation of sand, mud or gravel, thrown up by the sea at the mouth of the harbour. Bar of a river, mud or silt brought down by the river from the uplands; both being hindrances to entering or leaving.

BARE POLES. The state of a sailing vessel with all canvas furled, either lying to or scudding 'under' bare poles.

BARRATRY. A fraudulent act of master or mariners to the detriment of the owners (Legal).

BATTEN DOWN, TO. To secure the hatches with tarpaulins, which are kept in place by 'battens,' bars of wood or iron, placed in cleats along the coamings, and secured by wedges.

BEAM. *See* Abeam. 'Before the beam' comprises that part of the sea to the horizon which lies between the 'midship point and four points of the compass forward of it. Any object within that arc is 'before the beam;' forward of that, again, is 'on the bow.'

BEAM-ENDS, A SHIP ON. When she is so heeled over that the beams approach a vertical position.

BEAR, TO. The direction of an object from the ship, *e.g.*, The Lizard bears (or bore) N.E. 'To bear down,' is to approach another vessel from windward. 'To bear up,' to put the helm up and keep away from the wind. 'Bear a hand!'—hurry up!

BEARINGS. The widest part of a vessel below the sheer-strake.

BEATING. Working to windward by a series of tacks. 'Beating to windward.'

BED. A piece of wood on which a cask rests; or the indentation made in the mud by a stranded vessel, &c.

BEHAVIOUR. The action of a ship under canvas or the influence of the helm. "She 'behaves' well."

BELAY. To make fast a rope which has been hauled on. 'Belay there!'—Stop enough!

BEND, TO. To fasten one rope to another by certain 'bends' or hitches. To bend a sail is to fasten it to its yards or stay. Also 'Bend on.'

BENDS, OR WALES. The thickest planks of a wooden vessel's sides. The beam knees are bolted to them.

BERTH. The situation in which a ship rides at anchor. 'Snug' berth, a well-sheltered anchorage. To give a 'foul berth,' to anchor too near another vessel, endangering fouling if swinging towards each other. 'Berth,' a room or cabin where several live together.

BETWEEN-DECKS. Usually the space between the upper and the next deck below.

BIGHT. The loop part of a rope, in opposition to the ends. The space lying between two headlands. 'Bight of Benin,' &c.

BILGE. The part of a ship's floors where she begins to round up. The greatest circumference of a cask. 'Bilge-keels,' extra keels bolted along the bilges, sometimes called rolling-chocks.

BILL-BOARD. A shield bolted in the bows, to take the bill of the anchor.

BITTER-END, OR BETTER END. The part of the cable abaft the bitts, and therefore always in-board; hence it is often the 'better' end of the cable, having had less use.

BITTS. Timber heads for belaying ropes to.

BLEED, TO, THE BUOYS. To let the water out that may have leaked in.

BLOCK AND BLOCK. Or 'two blocks,' or 'chock-a-block,' the state of a tackle when the blocks have been drawn close together and it can no more be hauled on.

BLUE-PETER. The square blue flag with white square centre. (Letter P.) The signal for sailing.

BLUFF, full. Said of a vessel's bows; or a prominent, steep headland.

BLUE PIGEON. The sounding lead.

BOARD. The line over which a vessel passes betweeen tack and tack, when working to windward. To make 'short boards,' is to tack frequently. To make a 'stern board,' to come round (under stern way) on to the opposite tack, after having run head to wind. 'By-the-board,' close to the deck. 'The masts went by the board.'

BOATSWAIN. A petty officer in charge of rigging, a sort of leader to the crew.

BOLD-TO, OR STEEP TO. A shore which has deep water close up to the cliffs

BOLLARDS. Small bitts for making hauling lines fast to.

BOOT-TOPPING. The band of paint or composition put on about the water-line, or the outer sheathing put on a vessel of some age, outside the main planks.

BOTTOMRY. A contract by which money is borrowed, to allow a ship to complete her voyage (Legal).

BOUND. Going to. 'Where are you bound?' 'Tide bound,' neaped. 'Wind-bound,' prevented from sailing by foul winds.

BOW. The fore-end of the ship. 'On the bow,' anything in sight from ahead to four points towards the beam.

BOWER-ANCHORS. The working anchors.

BOWSE, TO. To pull on anything with a tackle. 'Bowse up!'

BOX, TO (the compass). To repeat the points, halves and quarters, in rotation.

BOX-HAUL, TO. To bring a ship sharp round on her heel.

BOX-OFF, TO. To make the ship pay-off when she is "in irons," or has come aback. (page 110).

BRACE. To brace up, to lay the yards more fore and aft by hauling on the braces. To brace by, to haul a yard to the wind, to shiver the sail when clewed up so that it may be easier furled.

BREAK BULK, TO. To begin to discharge cargo.

BREAK-OFF. A ship breaks off when close hauled, and the wind heads her so that she will not lie her course.

BREAK-SHEER, TO. When a ship in a tide way, sheered clear of her anchor, is forced out of such position by wind or current (page 144).

BREAKER *(barrico)*. A small water cask for boat's use.

BRING HOME, TO. When the anchor does not hold, the ship is said to 'bring home' her anchor.

BRING TO! An order from one ship to another to heave-to, that she may be boarded or spoken; also 'bring to,' the messenger to the windlass.

BRING UP. To anchor.

BRISTOL FASHION. In good style. 'Shipshape and Bristol fashion.'

BROACH-TO. To fly to the wind when scudding, through bad steering or the ship taking charge (page 121).

BROADSIDE. The whole side of a vessel.

BROADSIDE ON. The opposite to end-on.

BROUGHT BY THE LEE. When scudding with the wind quarterly, the ship flies off and brings the wind on the other quarter, and lays the sails aback (page 121)

BROW. The gangway plank.

BULK. The whole cargo. Grain or coal in bulk, loose, not secured in bags.

BULKHEAD. Partitions of boards dividing cabins or store-rooms, or permanent iron (water-tight) divisions in the hull (page 269)

BULWARKS. The vessel's sides above the decks.

BUNT. The middle of a furled sail

BUNTING. The stuff of which flags are made.

BUTT. The end joining of two planks or plates.

By. Close to the wind. 'Full and by,' close to the wind but with the sails full. 'By and large,' to the wind and off, within six points. 'By the head,' a ship trimmed deeper forward than aft. 'By the wind,' sailing as close to the wind as possible. To brace a yard by, to haul in on the weather brace after the sail is clewed up; to spill the sail so that it may be easier furled.

Cable's length. About a 100 fathoms = 200 yards. In charts a cable's length is 607·56 feet, or one-tenth of a sea mile.

Camber. The amount of upward curve in a ship's deck. Anything that has a curve up has 'camber.'

Cant, to. To turn or incline anything out of square. Cant timbers or frames, those at bow and stern which do not stand square with the fore-and-aft line.

Canvas, under. Under sail.

Carry away, to. To break. 'Topmast carried away.' Also used of a rope.

Carry on, to. To hang on to the sails when set, a little beyond prudence.

Carvel-built. A vessel built with all her planks flush edge to edge, and caulked, as all large wooden sailing vessels.

Cast. To cast anchor, to let go anchor. To take a cast of the lead, to heave the lead. To cast a ship is to pay her head off from the wind when lifting the anchor, so as to get her sails to draw. To cast off, to let go.

Catch a crab, to. To miss the water in rowing.

Catch a turn. Make fast quickly.

Catspaw. The ripples on the sea surface in a calm, made by light airs of wind.

Cat, to (the anchor). To haul it up to the 'cat-head' (page 50)

Caulking. Forcing oakum into the ship's seams, and then paying them with pitch.

Charter, to. To engage a vessel to carry freight. (Legal).

Check. To ease off a little, as of the braces, when very sharp up. 'Check her' with the anchor.

Chock. Chock-full, the sails all full when by the wind. Chock-up = close-up.

Choke-the-Luff. To shove the end of a rope across the sheave of a tackle to prevent the fall rendering.

Clap-on! Catch hold. To clap on sail, to make all possible sail.

Clean-full. Same as chock-full.

Clear. To clear the land, to get away from it. To clear a hold, to empty it.

Clincher, or Clinker-built. A vessel whose planks or plates overlap one another.

Clipper. A vessel built for fast sailing.

Clock-calm. Dead calm.

Close-hauled. When the bowlines are hauled taut-out, the yards braced sharp up and the ship close to the wind.

Close, To, with a ship or the land, to come nearer.

Coamings. The part of the hatchways raised above the deck.

Coat, Mast. A piece of canvas fitted round mast or bowsprit where they enter the deck or bows, to keep all watertight.

Composite-built. A vessel with iron frame, but wood outer planking.

Come. 'Come to,' to bring ship to the wind. 'Come up,' to slack up a rope or tackle. A close-hauled ship comes up when she lays nearer to her desired course. 'Come to anchor,' to anchor. 'To come home,' said of an anchor which drags, or does not hold.

COIL, TO. To coil down, to lay a rope on the deck in a ring one turn on another. To coil up, to lay a rope in bights on a belaying pin.

CONVOY. A fleet of merchant vessels protected by men-of-war.

CONN, TO. To direct or watch the helmsman.

CONSTRUCTIVE TOTAL LOSS. When the repairs of damage would cost more than the worth of the ship. (Legal).

COURSE. The compass direction which it is desired to steer. With a foul wind a ship will not 'lie her course.' With wind free she 'steers her course.'

COURSES. The lower sails, foresail, mainsail, cross-jack, sometimes 'fore-course,' &c.

COXSWAIN (Cock-swain). The steerer and man in charge of a boat. There used to be three—Boatswain, cock-swain, and skiff-swain.

CRACK-ON. To carry on.

CRANK. A vessel which, from construction or want of ballast, does not stand up well. The opposite to stiff.

CREW. The whole ship's company.

CRIMP. A sailor's robber.

CROW-FOOT. A number of small lines rove through a block of wood (uvroe) to suspend the bight of an awning.

CUNTLINE. The space between the bilges of two casks stowed side by side (page 224).

DAY'S-WORK.—The ship's reckoning from noon to noon.

DEADEN THE WAY, TO. To retard a ship's progress by luffing or otherwise.

DEAD-HORSE. Work which has already been paid for by the advance note. To work the dead-horse out.

DEAD FREIGHT. Money paid for cargo not carried.

DEAD-ON-END. A 'dead' foul wind, blowing from the point to which the vessel wants to go.

DEAD-RECKONING. The estimation of the ship's position when no 'sights' can be obtained.

DEAD-WEIGHT. Freight of heavy goods, shipped by weight, not measurement.

DEAD-WOOD. Blocks of timber spiked to the keel, at bow and stern, in the narrowing parts of the ship.

DEMURRAGE. Compensation money paid for delay. (Legal).

DEPARTURE. The bearing of a point of land from which a vessel starts her reckoning, or 'takes her departure.'

DEPTH OF HOLD. Height from the top of the floors or ceiling to the top of the deck beams, taken amidships at the inside of the limber strake.

DISBURSEMENTS. Money paid on ship's account. (Legal).

DISMANTLED. The state of a ship unrigged.

DISMASTED. A ship deprived of her masts by a gale.

DOG-VANE. A small vane to show the direction of the wind.

DOG-WATCH. Half watches—4 to 6 and 6 to 8 p.m., by which a change in the watches is effected.

DOLDRUMS. The parts of the ocean where calms prevail.

DOUBLING a Point or Cape. To sail round or past it.

DOUSE, TO. To slack down quickly. 'Douse the jib.'

DRAG, TO. The anchor drags when it 'comes home.'

DRAUGHT OF WATER. The depth to which a vessel floats, shown by figures on stem and sternpost. The lower edge of each figure is the even foot; the figures are six inches deep.

DRAW, TO. A sail 'draws' when filled by the wind. A ship 'draws' so many feet of water. 'Let draw!' is the order in tacking a fore-and-after when the fore-sheet is hauled aft on the new tack.

DROP. To drop anchor, to anchor. To drop astern, to be left behind.

DROGUE. A sea-anchor (page 315).

DUNNAGE. Loose wood, or rough cargo, used to stow the more choice freight on, to protect it from leakage or sweat.

EASE. 'Ease off,' to slack carefully. 'Ease the helm,' to put the helm down a few spokes when diving into a head sea. Or when the helm is hard over, to let it come back a bit.

EASE-UP. To come up handsomely.

EDGE AWAY. To keep gradually off the course.

END-OVER-END. Said of a boat turned over bow first by a heavy breaker.

END-ON. Opposite to broadside-on. End-for-end, to shift the used end of a rope with the unused end.

ENTRANCE. The form of the fore body of a vessel below water line.

EVEN KEEL. When the ship is trimmed to the same depth of water fore and aft.

EYE. The eye of the wind, the direction from which the wind blows. 'The eyes of her,' the extreme fore end of the ship.

FAIRWAY. The navigable channel of a river or harbour: vessels anchored therein lie in the fairway.

FALLING OFF. The opposite to 'griping,' or coming up to the wind when under canvas.

FEATHER, TO, an oar. To turn the blade horizontally when it comes out of the water, to lessen the wind pressure on it.

FEEL THE HELM, TO. Said of a ship when she begins to gather way, and to obey the helm.

FEND OFF, TO. To keep one vessel off another by a spar or fenders, &c.

FENDER (defender). Wooden or cork bulks to ease collision or chafe.

FETCH, TO. To reach. 'She will fetch to windward of the point.' Fetch away, said of anything which escapes from its place by the vessel's motion.

FILL, TO. To fill the sails by bracing the yards after they have been shivered or hove aback.

FIRST-RATE. A war-ship of 110 guns and upward. The rating of war vessels in this way is now obsolete. There used to be six rates.

FISH, TO, the anchor. The second process of getting an anchor stowed (page 36).

FLAT ABACK. When the sails are all brought aback so as to give the ship sternway. Flat aft, to haul the sheets as far aft as possible.

FLATTEN IN, TO. To haul fore-and-aft sheets *in* as far as possible.

FLEETING. Changing the place of a tackle further along on a rope when it has come 'two blocks.' 'Fleet along!'

FLEMISH ACCOUNT. A deficit. 'There'll be a Flemish account of that!' means 'You'll find yourself short of it.'

FLOGGING THE CLOCK. Putting the clock ahead surreptitiously.

FLOORS. (Page 42 and Plate 41).

FLOTSAM. Shipwrecked goods floating and becoming derelict property. (Legal).

FLOWING SHEET. The sheets eased off before a fair wind.

FLUSH. Level. A flush deck, a continuous level deck from stem to stern.

FLY OF A FLAG. The outer part of the flag, away from the staff.

FLYING KITES. Lofty light sails; as the clippers' moon-sails, studding-sails, and the like.

FLY. (Let fly) to let go suddenly.

FOOT. The lower end of mast or sail. Footrope, that on which the men stand when furling a sail.

FORE AND AFT. From head to stern. Or in line with the keel, being the opposite to athwartships.

FORECASTLE. A raised structure at the fore end of a vessel; in full, topgallant-forecastle.

FORGE AHEAD, TO. To shoot ahead.

FOUL. Opposite to clear. A ship fouled us. A foul anchor, an anchor which comes up with the cable foul of it. Foul berth (see Berth). Foul ground, bad anchorage. Foul wind, with which a ship cannot lay her course.

FOUNDER. To sink.

FOX, A. Ropeyards twisted up together and rubbed smooth with a piece of hard tarred canvas. Spanish Fox, a single yarn twisted up the wrong way and rubbed down.

FRAP, TO. To bind tightly together.

FREE. A vessel is 'going free' when the sheets and braces are eased; more than this is 'going large.'

FREEBOARD. The distance (amidships) between the line of curve of the top surface of the main deck, where it cuts the side, and the (salt) water line.

FREIGHT. The payment for goods carried. (Legal).

FRESHEN THE NIP, TO. To veer a little cable to let another part bear the friction; same of a towing hawser, &c.

FULL AND BY. Sailing close hauled.

FURL. To roll up and make fast a sail.

GAGE, Weather or Lee. A ship to windward of another has the weather gage; the other has the lee gage.

GALLEY. The ship's kitchen.

GAMMONING. The lashing by which the bowsprit is secured to the cutwater.

GANGWAY. The entrance and exit to and from a vessel, whether by ladder or otherwise: thus 'gangway ladder.'

GANTLINE. A single rope or whip for hauling up other gear to its place aloft.

GARBOARDS (Plates 39 & 122a) or Garboard Strakes. The planks next to the keel.

GASKETS. Ropes, or sennit, used for making sails fast.

GATHER WAY, TO. To begin to move under the impulse of the wind or the engines.

GEAR. Rigging of any kind.

GIVE. To give chase, to pursue. Give way, to begin rowing. Giving, a new rope stretching to a strain, or a seizing giving way.

GOING ABOUT. Tacking. Going free, sailing with the braces eased. Going large, sailing off the wind.

GOOSE-WING, TO, a topsail—to leave the middle part furled and set the clews.

GRANNY. A knot tied wrongly, particularly a reef-knot.

GRIPE, TO. When a vessel is inclined to run into the wind against the helm. 'The gripe,' the outside timber of the fore-foot under water. 'Gripes,' boat's lashings.

GROUND TACKLE. Anchors and cables.

GUDGEONS. The eyes on the sternpost into which the rudder pintles ship.

GUESS-WARP. A small rope run out to a buoy, by which to haul out a boat with a heavier rope or chain aboard.

GUNWALE. The upper rail of a boat or vessel.

HAIL, TO. To speak another vessel.

HALLIARDS (or haul-yards). Ropes or tackles for hoisting yards or sails.

HAND. A man. 'A hand in the chains!' To hand, is to furl a sail. Lend a hand, to assist. Bear a hand, make haste. Hand-over-hand, rapidly.

HANDSOMELY. Slowly, carefully. 'Lower handsomely!'

HANDY-BILLY. A watch tackle.

HARD. 'Hard up,' up with the helm. 'Hard-a-lee!' down helm. 'Hard-a-port,' &c.

HARD-AND-FAST. Said of a ship aground.

HAUL, TO. To pull. A ship hauls her wind when she trims her yards to sail close. 'The wind hauls forward,' veers aft, though *haul* is used for this also.

HAWSE. The part of the bow where the hawse-pipes are. Thus, athwart hawse (see Athwart).

HAWSER. A large rope for towing or securing a vessel.

HEAD. The fore part of the ship. Then, 'head-way,' 'head sails,' &c.

HEAD TO WIND. A vessel dead on to the wind in tacking or at anchor.

HEAD-WAY. Moving ahead. 'Head-wind,' a foul wind.

HEAD SAILS. The jibs and fore-topmast staysail.

HEART. The centre of a rope.

HEAVE-TO, TO. To adjust the sails, some full, some aback, so that the vessel's way is stopped. 'Heave short,' heave in cable till just enough is left to hold the ship.

HEEL, TO. To lie over from any cause. The heel, the after end of the keel. Heel of a mast, the lower end.

HELM. Properly the tiller. Down helm, up helm, &c. Helmsman, the steersman.

HIGH AND DRY. A vessel left dry by the tide.

HOGGED. A vessel whose ends droop by straining is hogged.

HOIST, TO. To raise anything. 'Hoist the topsails!' 'Hoist our ensign.'

HOLD UP, TO. The weather holds up, *i.e.*, is clearing. The hold, the lower part of the ship, in which cargo is stowed.

HOLIDAY. Any part left uncovered in tarring or painting.

HOME. Into its place. 'Sheet home,' haul the sheets chock out. An anchor comes home when it drags.

HOME-TRADE. Between the Elbe and Brest. Further than this is foreign.

HOOD-ENDS. The ends of the planks which fit into the rabbets of stem and sternposts.

HOUNDS, of a mast (Plate 3). Projections on which the trestletrees rest.

HOUSE, TO, a mast, is to lower it half its length, and secure it so. To secure. The housing of a lower mast, the part below the deck.

HULL. The body of a vessel.

HULL UP. A vessel at a distance that her hull can just be seen. 'Hull down,' when only the masts can be seen.

IN. Sails furled are 'in.' 'In royals!' is the order to 'take in' those sails. Inboard, within the ship.

INSHORE. Close with the shore. 'In the wind,' a ship with her head thrown into the wind.

INDENT. A list of stores required.

IRONS, IN. A ship is thus when she is allowed to come into the wind and lose her way, so that she hangs there.

JACK. The Union flag. Merchant signal for a pilot.

JACKSTAYS. Long rods of iron along the yards, to which the sails are bent.

JETSAM. Goods cast into the sea. (Legal.)

JIBING, or Gybing. Shifting over the booms of a fore-and-after when bringing the wind from one quarter to the other.

JIGGER-MAST. The after-mast in a four-masted vessel.

JURY-MAST. A temporary mast rigged at sea after being dismasted.

KEEL-LEG, Kellick. Slang for anchor.

KEEL (Plate 122a). Keelson, same plate.

KEEP. 'Keep her away,' is keep off the wind. 'Keep your luff,' is keep close to the wind. 'Keep hold of the land,' is to hug it as near as safety allows. Then, 'keep watch.' 'Keep full.' 'Keep off,' &c.

KENTLEDGE. Permanent iron ballast.

KNOCK OFF. Leave off work.

KNOT. (See pages 10 and 24).

LABOURING. A ship pitching, or rolling heavily, labours.

LAND-FALL. Making the land.

LARGE. Sailing large is going with the wind free.

LAY. To come or go. 'Lay aloft.' 'Lay aft.' 'Lay-to,' to stop a vessel's progress. (See Heave-to.) A ship lays her course if the wind allows.

LEACH. The edge of a sail, at the side.

LEADING WIND. Wind abeam, the wind free.

LEAK. A hole or rent in a vessel allowing the entrance of water.

LEEWARD. The side opposite to which the wind is blowing.

LEE-WAY. What a vessel loses by drifting to leeward.

LET RUN. Cast off quickly. 'Let fly' has a similar meaning.

LIGHT, TO. To lift over. 'Light out to windward.'

LIMBERS. The water-course to the pumps, along a ship's bottom.

LIST, TO. To lean on one side. 'She has a list to port.'

LIZARD. A stropped thimble made fast to the halliards of a yard before all, for the buntline to reeve through, keeping it into the yard and preventing its being hauled too high up.

LOG. Ship's journal. To be logged, to have one's faults entered in the log.

LONG-BOAT. The principal boat.

LONG-JAWED. A rope whose strands are straightened out by strain, or bad workmanship.

LOOM, TO. An enlarged appearance of ship or land in mists or fog. 'She looms up large.' 'There's the loom of the land!'

LOSE WAY, TO. When a vessel slackens her way.

LOWER. To let down by rope, tackle, or halliards. 'Lower the boat.'

LUFF. Let her come to the wind.

LURCH. A heavy roll.

MAKE. To make bad weather, to behave badly, said of a ship. Make fast, belay. Make it so, the captain's order confirming the time when reported. Thus, 'It is eight bells, sir.' 'Make it so.' Make sail, to set more sail. Make water, the act of a ship leaking.

MAN, TO. To place people for duty. Thus, 'Man the windlass.'

MAN-HANDLE. To move by manual force, without tackles.

MASTER (in full, Master Mariner). The title of the commander of a merchant vessel, be she mail-boat or small sailing vessel.

MATES. A ship's officer under the master.

MARRY, TO. To join the ends of two ropes so that they will pass through a block. Also a term in stowing bales.

MEET HER! with the helm. To prevent her coming any further this way or that.

MESS. A number of the crew who lodge and feed together.

MISSING STAYS. To fail in coming round when tacking.

MOOR, TO. To ride with two anchors.

MOUSING. A fastening of yarn on the jaws of a hook to prevent its unhooking.

MOULDED DEPTH. The perpendicular depth from top of upper deck beam at side, at the middle of vessel's length, to the top of keel (in spar and awning decked ships from the top of main deck beams).

NEAPED. A ship in a dock or bar harbour which cannot get to sea until spring tides. Neap tides, low tides.

NEAR. Close to the wind.

NINES, up to the. An expression denoting perfection.

NO HIGHER! Come no nearer the wind.

NORMANS. Iron bolts, sometimes shaped like a staple, shipped into the windlass to keep the chain clear when running out.

NOTHING OFF! Go no further off the wind.

OFF. Abreast of. Off Dover. Off and on, nearing shore on one tack and receding from it on the other. Off duty, in the watch below.

OFFING. Distance from shore.

ON. There is a heavy sea on. On a wind, or a bowline, close to the wind. 'On deck there!' the call for attention from aloft.

ON END. A topmast or topgallantmast in its place and fidded.

ON THE BEAM. On the bow, &c.

OPEN HAWSE. A vessel riding by two anchors without a cross in her cables. Open roadstead, an unsheltered anchorage.

OUTFIT. The stores and equipments for a voyage.

OVERHAUL. To slack up a rope or tackle freely. A ship overhauls another when she comes up with her.

OVERLADEN. When the load-line for the season is submerged in salt water; said of a ship when she has more weight than she can fairly carry.

PADDY'S HURRICANE. A calm.

PAINTER. The rope in a boat's bows used for making her fast.

PART, TO. To break; said of a rope. A cable parts and the vessel goes adrift.

PARTNERS. The framework in the deck which receives a mast.

PAY. To pay, to pour pitch into caulked seams. To pay out, to slack or pass out. To pay off, of a ship, when her head falls off from the wind.

PAWL-BITT. The standard, of wood or iron, fixed in front of the windlass, which supports the pawls and gives security to the windlass.

PEAK. The extreme end of a vessel's hold. 'Fore peak.'

PENDANT (sometimes wrongly Pennant). A length of rope to which a purchase is hooked.

PENNANT. A long narrow flag.

PITCHING. Plunging into a head sea.
PLAY. The motion in masts, the ship's frame, &c. 'It has too much play.'
POOP. The raised structure at the stern of a vessel.
POOPED, Being. The breaking of a sea over the stern.
PORTAGE BILL. The account of the ship's company's wages. (Legal.)
PORT. A place of resort for vessels of commerce. The left side of a ship—so, to 'Port the helm.' Ports, the openings in a ship's sides for guns or windows.
PREVENTER. An additional rope or spar for support. 'Preventer brace.'
PROTEST. A declaration, before a notary or a consul, by the master, mate, and part of the crew, that the ship has met with heavy weather, and damage to the cargo is expected.
PUT. Put about, to go on the other tack. Put back, to return to port. Put in, to enter a port in the course of a voyage.
PUT TO SEA. To leave port.
PURCHASE. A tackle, or mechanical power.
QUARTER. From four points abaft the beam to right aft. Then quarter boats, lee quarter, &c.
RABBETT. A shaped groove in keel, stem, or any other timber, to receive the edges of the planks.
RACE. A strong tidal current off a point or in a narrow channel.
RANGE, TO. The cable. To haul up enough slack cable from the locker so that the anchor may go down with ease.
RAP-FULL, Keep her. Do not come too close to the wind.
REEF, TO. To reduce a topsail or course by taking in on its head, for which 'points' are provided. A reef, a ledge of rocks.
REEVE. To pass a rope through a block or dead-eye. Unreeve, the opposite.
RENDERING. The act of yielding to any applied force. A lanyard 'renders' through a dead-eye.
RESPONDENTIA. A loan, made on the cargo. (Legal.)
RIDE, TO. At anchor. To ride out a gale. To ride easily.
RIGHTING. A ship recovering herself. Right the helm, put it amidships. Right up and down, said of the wind in a calm.
ROACH. The curve in the foot of a square-sail.
ROAD, or Roadstead. An anchorage.
ROUND IN, TO. To haul in, as of weather braces.
RUN, THE. The narrowing after-part of a vessel's bottom. To let go by the run, to let go altogether instead of slacking gradually. To run (see Scud).
SAGG, TO. To bend under a weight. A ship sagged is when her 'midships has drooped. Opposite to hogging.
SAGGING TO LEEWARD. Drifting bodily to leeward.
SALVAGE. An allowance made to those who save a ship or goods. (Legal.)
SCARPH. The join of two pieces of wood forming one timber, as a keel or stem.
SCOTCHMAN. A chafing batten.
SCUD. Low misty cloud. To scud, to run before a gale.
SCULL, TO. To impel a boat by one oar at the stern.
SEA. To ship a sea, to take heavy water aboard. A heavy sea, high waves. Sea-going, fit for service.
SEA-WAY. A place where the sea is heavy. Sea-worthy, in every way fit for a voyage.

SEND, or Scend. A heavy pitch into the trough of the sea.

SERVE, TO. To wind yarn round a rope to preserve it.

SERVICE. The stuff so wound.

SET The direction of a current or tide. Set sail, *i.e.*, make sail. Set up, to tauten rigging.

SEWED. A ship aground and left partly by the tide, is said to be 'sewed' by as much as the distance between the surface of the water and her load-line.

SHAKES. No great shakes, not much good.

SHAKINGS. Waste bits of rope yarn, canvas, or worn-out rope; usually a perquisite of the boatswain.

SHARP UP. The yards trimmed as near fore-and-aft as they will brace.

SHEER. The longitudinal curve up of a ship's sides (see page 142) Also, the position in which a ship at anchor in a tideway is kept.

SHEER-STRAKE. The line of planking or plates next below the covering board.

SHEET. The rope securing the after clew of all sails when set, except the topsails and the square sails above them, which have two sheets. Sheet anchor, the largest, stand-by, anchor. (See Home).

SHIFT. To change. To shift a topsail, or the helm, or a berth. Cargo shifts when it runs to one side through the motion of the vessel. The wind shifts when it changes its direction.

SHIP-SHAPE. Seamanlike.

SHIP, TO. To fix anything in its place. 'Ship the capstan bars.'

SHIVER, TO, a sail. To brace its yard or slack its sheet, so that it shakes in the wind.

SIGHT. Sighting the land, coming in with it to get a view. To sight the anchor, to heave it up in sight, to see it is clear.

SIGNALIZE. To signal by flags.

SLACK. The part of a rope or sail that hangs loose. 'Take in the slack.' To slack, to ease up a rope. Slack helm, when a ship does not carry proper weather helm. Slack in stays, slow in going about. Slack water, the interval between ebb and flow, when the tide current has almost or entirely ceased.

SLANT OF WIND, A. A breeze which may be taken advantage of.

SLIP, TO. To let a cable run and stand out to sea.

SLUE, TO. To turn round.

SMALL HELM. A ship well trimmed will, under a smart helmsman, be steered with 'small' helm, or a very few spokes of the wheel—the essence of good steering.

SNUBBING HER. Bringing a ship up suddenly with the anchor, but without putting undue strain on anything.

SOLDIER'S WIND. One which serves either way. As a wind due north in the English Channel.

SOUNDINGS, IN OR ON. When a ship has reached the 100 fathom line near shore, upon which soundings with the ordinary deep sea lead and line can be taken.

"SOUND THE WELL." See what water she has in her. (See Well).

SPARS. All masts, yards, booms, and gaffs, &c.

SPELL. A rest. Or when two or more gangs are employed on one job (say pumping), one gang spells the other. 'Spell O!' the call for relief.

SPILL. (See Shiver).

SPLICE THE MAIN BRACE. To serve out extra grog after some special labour.

SPOON-DRIFT, OR SPIN-DRIFT. The misty showers of water swept off the heads of waves in a heavy gale.

SPRING, TO. To crack or split a spar, short of breaking it. To spring a leak, to start leaking. A spring, a warp run out to check or slue a vessel.

SQUARE. To square in, to brace the yards more square with the fore-and-aft line. Very 'square' yards mean yards of great length.

STAND, On or Off. To approach or recede from an object. 'Stand in for shore!' Not a mast standing, totally dismasted.

STAND BY! Be ready! Stand from under! Look out below! Standing part, the part of a tackle which is fast and stationary, in opposition to the end hauled on.

STARBOARD. The right side looking forward. Starboard the helm, bring ship's head to port (with head way).

START. To move. To start a tack, to slack it off. To start a cask, to knock the bung out and empty it, &c.

STAY. To tack. (See Miss stays, Slack in stays). To stay a mast, to incline it forward or aft by the stays and back-stays.

STEADY! The order given to the helmsman, to steady the ship's head at a certain point.

STEEP TO. Same as bold to, which see.

STEER. To direct the ship by the helm. Steerage, formerly the lower deck where the tiller was, and where the ship was steered. Now, the deck where "steerage" passengers are berthed. Steersman, the helmsman.

STEEVE. The cock up of the bowsprit, its angle from the horizon.

STEM. The chief bow timber. To stem, to make way against. "She stems the tide." Stemson (same plate).

STEP. The iron or wood seat of a mast, into which the keel fits.

STERN-BOARD. (See Board).

STERN. The after end of the vessel

STERN-POST. (Plates 1, 2, and 122a, Fig. 2). The principal after-timber.

STERN-SHEETS. The after (seating) part of a boat.

STIFF. The quality of standing up well under canvas, opposed to crank.

STOVE. Broken. Said of a ship, or cask, or case, when broken from outside, 'Stove in.'

STOP-WATER. A treenail driven through stem and keel at their joining.

STOWAGE. The important art of stowing a cargo.

STRAND, A. Yarns twisted together. Three strands compose an ordinary rope.

STRANDED. A rope with one of its 'strands' parted, or a vessel driven ashore.

STRANGE SAIL. An unknown vessel in sight.

STREAM, TO. A buoy or log, to let it run into the water, keeping the line or buoy-rope aboard.

STRESS OF WEATHER. (Distress.) That which causes a ship to put back.

STRIKE, TO. Of a ship touching the bottom. Also to lower or 'Strike topmasts!' 'Strike your flag!' To strike soundings, to gain the first soundings on coming in with the land.

STRINGERS (Shelf-pieces). Internal strengthening strakes of timber or iron to receive the ends of the beams—sometimes placed, in iron vessels, where a lower tier of beams would otherwise come.

STROKE. A single pull of the oars in rowing. Stroke oar, the aftermost rower, who gives the time of stroke.

STROP. The rope fitting of a block.

SURGE, TO. To slack suddenly, as of a rope round a capstan or winch barrel, to prevent the turns riding.

SWAMPED. Overwhelmed by the water, a boat filled by a sea is 'swamped.'

SWEEPING. Dragging the bight of a rope along the ground to recover an anchor.

SWIFTERS. The foremost pair of shrouds on a lowermast.

SWIG-OFF, TO. To pull at the bight of a rope with its lower end round a pin; a method of putting more weight on a rope.

TACK, TO. To go about (page 105). 'On starboard tack,' when the starboard tacks are aboard and the wind on the starboard side. 'Port tack' the opposite. The tack of a fore-and-aft sail is its forward lower clew. The tack of a course is the rope holding down its forward clew.

TACKLE, GROUND. Anchors and cables.

TAIL ON! Clap on a rope.

TAKING IN (Sail). Shortening sail. Taking off, said of tides when decreasing towards neaps; or of a decreasing gale, 'the wind is taking off.' 'Taking charge,' said of a cask or any other thing which has 'fetched away,' and is rolling from side to side of the ship; or of a ship in a squall when the hands are too weak to get the sail off her, 'She has taken charge.'

TAUNT. High or tall.

TAUT. Tight. A taut hand, a strict officer.

TELL-TALE. The compass in the cabin by which the master can check the steering.

TENDER. Said of a crank ship.

TENON. The square heel of a mast cut for fitting into the step. The sternpost is also tenoned to the keel, &c.

THERE! A word of hail. 'Forecastle, there!' &c.

THOROUGH-FOOT. A foul turn in a tackle, through one of the blocks having been dipped round one of the parts.

THWART-SHIPS. (See Athwart.)

THWARTS. The seats of a boat.

TILLER. The iron or wood handle by which a rudder is directed.

TOUCH AT, TO. To call at an intermediate port.

TOUCHING. The ship's sails with their weather leeches just shivering in the wind.

TOW, TO. To draw a vessel along. Tow-boat, tug-boat, a steamer employed for that purpose.

TRICK. The allotted time for a man to stand at the wheel. He takes his trick at the helm.

TRIM. The set of a ship in the water, by the head, or stern, or on an even keel. To trim sail—to brace the yards so that the sails are placed to the best advantage to receive the wind. To trim cargo, such as coal or grain—to arrange it securely in the hold, so that the ship is upright. Trimmers, labourers who 'trim' cargo.

TRANSOMS. The chief inside supports across the stern, secured to the stern-post.

TRIP. An outward or homeward passage. A-trip, the state of the anchor when just off the ground in heaving up, the same as 'a-weigh.'

TREENAILS. Wooden bolts of hard wood used as fastenings in wooden vessels.

Trough. The hollow between waves, lengthwise.

Tumble-home. The part of the ship's side which curves inward above the extreme breadth.

Turn. Turn in, to go to bed. Turn out, to get up. Turn turtle, to capsize. Turn the hands out, call all hands. To turn to windward, to make a series of tacks. 'Catch a turn,' make fast.

Ugly. A threatening appearance of weather.

Unbend. The opposite to bend (which see).

Under (see Bare-poles, Canvas). Under foot, under the ship's fore-end. Under-manned, short handed. Under the lee, sheltered by land or breakwater, &c. Under-tow, a strong under-current below surface. Under way, a ship beginning to move under her sail or steam. Under weigh, when the anchor is 'weighed,' or off the ground.

Union-jack. The national flag, ashore or afloat.

Union-down. The ensign hoisted upside down, a signal of distress.

Unmoor. (See Moor.)

Unreeve. (See Reeve.)

Unship. (See Ship.)

Up. 'Up anchor!' the order to weigh. Up-and-down, the position of the cable when hove quite short. 'Up helm,' put the helm a-weather (which see).

Veer, to. To slack out, or pay out. To wear (which see). When the wind comes aft it veers; it *hauls* forward.

Waister (now often Waster = Wastrel). Green hands or old men stationed in the waist when working ship. A naval term. Now, a useless fellow.

Wake. The track of a ship in the water astern.

Wall-sided. A ship which has no 'tumble-home.'

Warp, to. To move a vessel about by means of warps, or heavy ropes, by hand, assisted by the capstan, or steam winches.

Watch. The division of the ship's company into two parties—starboard and port watches (Anchor and Dog Watch, see). Seamen usually keep watch-and-watch, but there are three watches. First watch, 8 p.m. to midnight; middle watch, midnight to 4 a.m.; morning watch, 4 a.m. to 8 a.m. During the day there are forenoon and afternoon watches, and the Dog-Watch. 'Watch there, Watch!' The warning in heaving the deep-sea lead. Watch-tackle, a handy-billy (which see). The anchor-buoy 'watches' when it floats properly and clear.

Water Ballast. Water used to stiffen a ship, usually in tanks constructed for that purpose. Water-borne, a ship afloat, clear of the ground. Water-laid, rope laid up left-handed. Water-logged, a ship full of water, but laden with so buoyant a cargo that she does not sink. Water-tight, the reverse of leaky.

Way (see Under Way). Head-way, stern-way, gather way, lose way, all apply to a ship's motions.

Wear. The opposite to tacking. To come round the long way about, keeping off till wind is dead aft, then coming-to on the other tack (page 88).

Weather side. To windward, or the side on which the wind blows,—opposite to leeward. Then, 'weather anchor,' 'weather beam,' &c. 'Weather helm,' a well trimmed ship, when on a wind, should carry the helm a little 'up,' or 'a-weather.' Weather eye,—'keep your weather eye lifting'—look out sharp. To weather, to fetch to windward of.

WEATHERLY. Said of a ship with good qualities for working to windward.

WEATHER TIDE. A tide running contrary to the wind's direction, tending to set an anchored or unanchored ship to windward.

WEIGH, TO. To up anchor.

'WELL!' That will do! As 'Well the main yard!' in bracing. The well, the chamber in the limbers beneath the pumps where the depth of water in the ship is 'sounded.'

WHERE AWAY? On what bearing?

WHELPS. Pieces of iron bolted on the windlass for the turns of the chain to ride on.

WHOLESOME SHIP. One which behaves well under all conditions.

WIND-RODE. A vessel riding head to wind in a tide-way, the wind being stronger than the tide: opposite to tide-rode.

WINDWARD, TO. The weather side.

WINGS. The sides of the holds.

WITH THE SUN. Only applicable strictly to places north of the sun, but used everywhere to denote from left to right.

WORK, TO. When a ship strains in heavy weather. A day's work, working up the ship's position at noon.

YAW, TO. To deviate from the direct line of the course.

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## SECTION XXXIII.

# THE STEAM SHIP.

A young officer on first coming into steam will, unless he has read up the subject, be considerably ignorant as to the general internal construction and fittings of his vessel. Iron sailing vessels are usually constructed with one large main hold, and a laid 'tween deck with a single water-tight bulkhead right forward, usually termed the collision bulkhead. The bottoms of these vessels are (taking iron for wood) generally similar to that of a wooden vessel, but in steamers considerable difference will be found in all of these points.

*Fig. 1.*

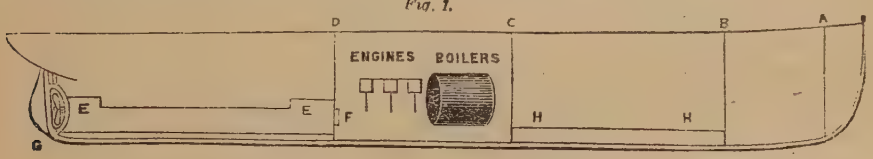



*Fig. 2.*

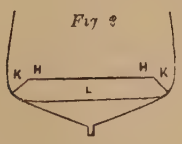



*Fig. 3.*

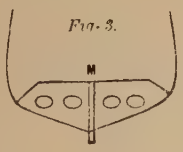



*Plate No. 119.*

We will presume that the section explaining the hull of a sailing ship has been carefully read, for it contains much that appertains to steamers; but, whereas the former have altered very little from the time of the introduction of steel hulls to the present date, steamers, have been designed in many different forms.

It is impossible to go into detail of the different designs, more especially as this is a book on seamanship, not naval architecture, but we will discuss the principal features.

In the sailing ship we have one bulkhead, and in steam vessels according to Lloyds' rules, there must be a collision bulkhead not less than 5 per cent. of the vessel's length from the forepart of the stern at the load water line; an after peak bulkhead, and bulkheads dividing the machinery space from the cargo and passenger spaces That makes not less than four bulkheads.

Any addition to these depends upon the length of the vessel, and the rules stipulate that if the length of the vessel is over 285 feet and not exceeding 335 feet, an additional bulkhead must be placed about midway between the collision and boiler-room bulkheads.

Above 335 feet and not exceeding 405 feet in length an additional bulkhead in the after hold.

In each of the following cases a further additional bulkhead must be added with the increase of length.

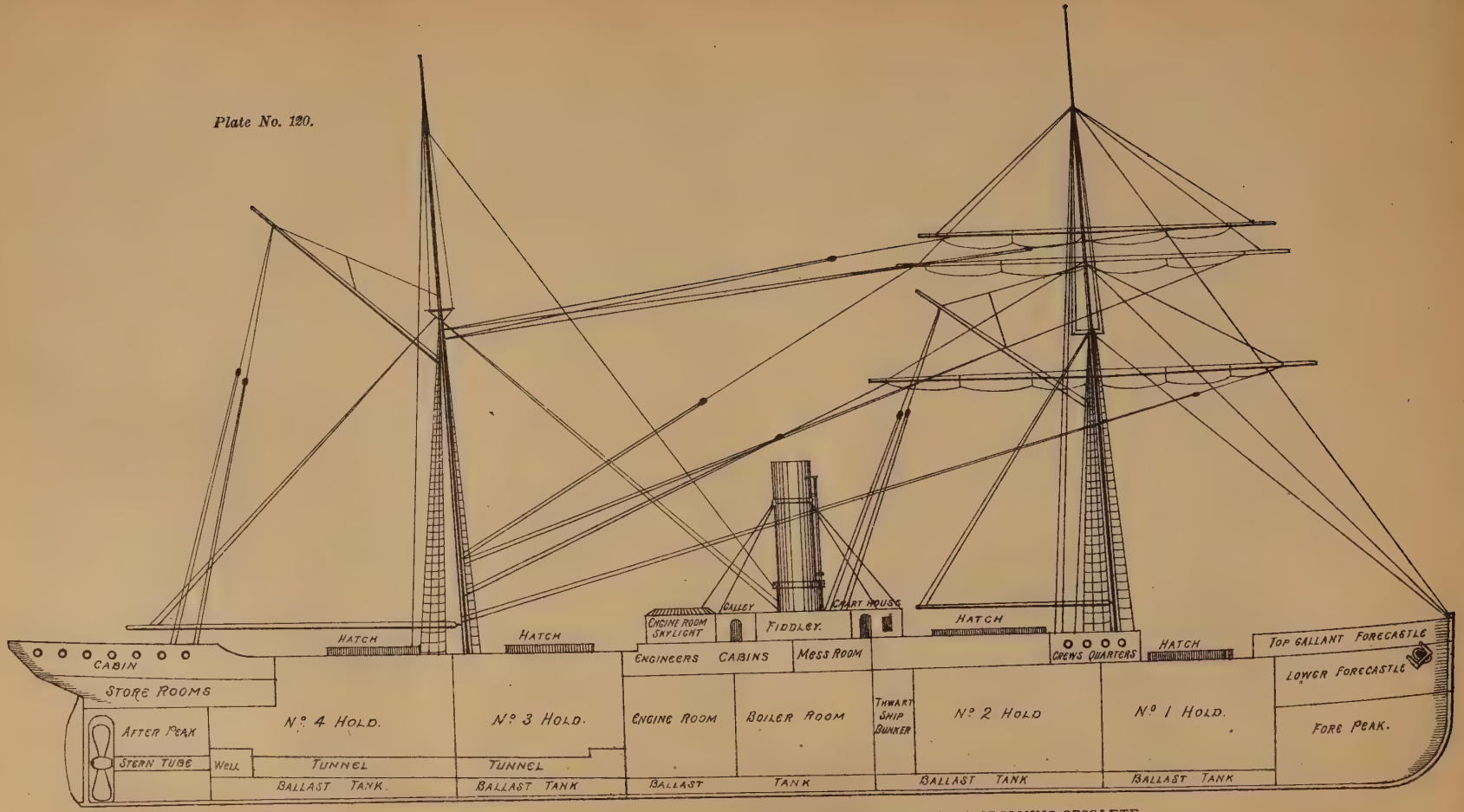
Above 405 feet and not exceeding 470 feet in length.
Above 470 feet and not exceeding 540 feet in length.
Above 540 feet and not exceeding 610 feet in length.
Above 610 feet and not exceeding 680 feet in length.

Total this up and you will find that we have reached the number of *not less* than 10 bulkheads, and with the increase of the length of modern steamers so will the minimum number of bulkheads required be increased.

In *Plate No. 120*, illustrating the profile of an American liner, there are 15 bulkheads.

The steamer shewn in *Plate No. 119* has at *A* her collision bulkhead, water-tight so called. At *B* is another water-tight iron or steel bulkhead, separating fore and main holds, usually termed No. 1 and No. 2 holds. At *C* is the bulkhead at fore-end of boiler space; this usually has two small water-tight doors at the bottom for the purpose of trimming coal through if any of the bunker coal is carried in the main hold, part of which is usually bulkheaded off to form a thwartship bunker.

*Plate No. 120.*




**FAVOURITE TYPE OF A CARGO STEAMER, ALTHOUGH THE FITTING OF YARDS IS BECOMING OBSOLETE**

With raised Quarter Deck and long extended Bridge

At *D* is the bulkhead at after end of engine room. This has a water-tight door in it at *F*, by which ingress is gained to the shaft tunnel *E E*, which is also water-tight.

The engineers require to be able to get along this tunnel to oil the bearings of the shaft.

You can judge by this that the door is of sufficient size to admit of a fairly large body of water through, and in case of accident to the after end of the vessel it might have to be closed in a hurry. The law stipulates that it must be capable of being closed from the upper deck, so it is very advisable that all officers should know exactly where the control is and how to use it.

It will be noticed at *G* that the keel rises up from the straight line. This is done so that, should the vessel's keel touch the ground, the main body of the ship may take the blow, and the rudder and after-post be spared.

The next great difference between a sailing ship and a steamer is in the construction of the bottom.

A modern steamer is invariably fitted with water ballast, and this is contained in a form of double bottom, the most usual types of which are the water ballast tanks proper and the cellular double bottom.

In the former case the ballast tank is fitted to the top of the floor plates, and in the latter, which is much the more common, the water ballast is contained between the bottom of the vessel and the upper or second bottom, this latter being of sufficient strength to keep the vessel afloat if the outer bottom of the vessel should get pierced.

Referring to the transverse section, Fig. 2. *H* is top of the ballast tank; at *K* the sides slope down, forming gutters in the holds, to which any water that may enter drains itself.

In these gutterways there are in each bulkhead small openings, which are opened or closed at will by little doors worked from the upper decks by rods; these are called sluices, and are for the purpose of allowing any water that may accumulate in one hold to run into the next, or (if at bulkhead *C*) into the engine room bilges, where it can be pumped out. *(Plate No. 119).*

This double bottom, or tank, is filled with water when the vessel has no cargo on board (or such a light freight as coke or cotton), and ballasts the ship.

Although the cellular double bottom invariably extends from collision bulkhead to after-peak bulkhead, it is divided into water-

tight compartments, such divisions running athwartship and to be at or near each bulkhead required by the rules.

There are, however, many steamers that have water-tight longitudinal bulkheads in addition to the athwartship ones, and they must be equal in strength and stiffness to the latter of the same depth.

It stands to reason that these extra divisions in the fore and aft line of the ship are extremely useful in trimming the vessel when required.

Most steamers when in ballast roll fairly heavily owing to the weight being at the bottom, and this, independent of not being conducive to the general comfort of those on board, has a deteriorating effect on hull, machinery and speed.

To lessen this trouble recourse has been had in some cases to the fixing of side ballast tanks well up in the wings of the vessel, and these can be drained into the cellular double bottom.

As a rule, when in ballast, all these tanks are kept chock full, and when laden, empty. (The merchant seaman need not exercise his mind as to whether a half-filled tank will ease the rolling of a vessel, for the ordinary tank top will not stand such a strain as a half-filled tank would put on it.)

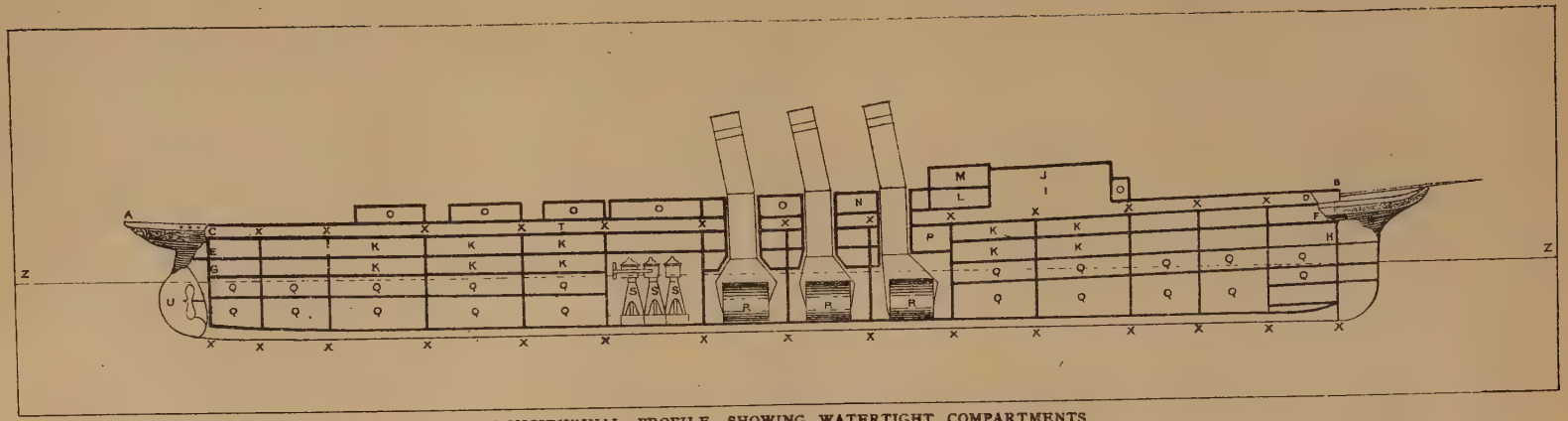
It will be noticed that the floors *L* do not in this case reach the top of the tank. In the cellular double bottom, which is of an entirely different construction, the floors come up to the tank top, each plate having large passage holes cut in it. This form of bottom is shewn in transverse section *M*.

Each ballast tank has one, generally two, sounding pipes to it. These pipes and the bulkhead sluices are in the carpenter's charge. If any hold has no ballast tank, there will be a sounding pipe fitted to it all the same; and in addition to the sounding pipe of the tanks, there is one alongside of every sluice for sounding the holds.

This series of pipes should be sounded regularly every four hours. A slate or black board, properly marked, is kept in the engine-room, and the carpenter, after sounding, should mark on this board the inches of water he finds in each hold or tank, that the engineer may see no accumulation of water takes place.

All pipes and connections to the ballast tanks and holds are in the engine-room, and of course under the care of the engineer, and if any pumping is required, he is the one to do it.

There are deck hand pumps fitted to each compartment, but it is never necessary to use them unless in a time of emergency, or when steam is not up, in either donkey or main boilers. They should, how-




LONGITUDINAL PROFILE, SHOWING WATERTIGHT COMPARTMENTS

| | | | | | |
|---|---|---|---|---|---|
| AB | Promenade Deck | L | Drawing-Room | R | Boilers |
| CD | Saloon Deck | M | Bridge | S | Engines |
| EF | Upper Deck | N | Library | T | Smoking-Room |
| GH | Main Deck | Q | Promenade Deck Suites and Cabins | U | Rudder |
| I | First Cabin Dining Saloon | P | Kitchen | XX | Watertight Bulkheads |
| J | Dome of Dining Saloon | Q | Cargo Compartments, Baggage and Store Rooms | | |
| K | State-Rooms | | | | |

*Plate No. 121.*

ever, be carefully looked after, and the lower boxes drawn and looked at occasionally. The standards and handles of them should be marked and kept in a rack in a handy place, and here also all keys for sluices, the pump hook for lifting the lower boxes, and the sounding rod and line should be kept. The young officer first coming into a steamer should be very careful of these matters, and consider it as one of his most important duties. The sluices, even though not in use, should be oiled and worked full up and down every week, to see that they are free, and work to the open and shut marks.

Holds not fitted with tanks connect with the engine-room steam pump (donkey) by pipes. At the end of these pipes is fitted a box perforated with holes, termed a strum; this is to prevent rubbish or dirt being sucked into the pipe. These strums are placed between two of the after-floors in each tank; they should never be made of lead.

Limber-holes and sluices are often small for the work they have to do. It is a good plan to have a galvanised chain led through all the limber-holes, under coal bunkers and boilers; they are very useful in keeping them clear.

Whenever the holds are empty, the carpenter should always see that the strums are clear and free when the bilges are being cleaned out.

When it is required to fill a ballast tank, the tops of the sounding pipes must *always* be taken off, to allow the escape of air from the tank as the water enters.

Some vessels with deeper tanks than ordinary take strong lists when the tanks are being run up. Care must be taken in such a case that the ship does not part her lines, if at a wharf, or damage herself against the quay side.

In these modern days of hurry, much neglect is often shewn with regard to the efficiency of sluices, pumps, and strums, and many steamship officers are, unfortunately, culpably careless in these seemingly small matters. The young mate must never fancy himself too big to attend to these most important things; if he does, damage and disaster will be the probable result.

When at sea it is advisable to keep the sluices open fore and aft, as in that case if any water accumulates in the bilges it drains into the engine-room; and if the ship chances to strike anything at sea about her bilges, or in any part below the water-line above the tank tops unknown to the officer of the watch (which is quite possible in heavy weather) so as to cause a leak, the engineer on watch would soon see that something was wrong by the water rising in the engine-room bilges, or by the working and throw of the bilge pumps, which he continually looks out for during his watch. If the sluices were shut this would not be the case. Here is a case in point.

In the depth of winter, when the iron buoys at the Elbe were removed and replaced by large log buoys on account of the ice, a steamer only a few months old was steaming down the river on a dark night. She struck one of these buoys, the blow was not noticed by the officer on the bridge; the man on the look-out observed a blow, but did not report it. The sluices were all shut. When the vessel got some twenty miles to the westward of Heligoland she began to roll very heavily, and it was presently found that the fore hold was more than half full of water (the vessel was only in ballast). By this time a gale had sprung up from S.W., and before the water could be got out of the hold, or the ship run in under the lee of Heligoland, she started the fore hold bulkhead and foundered. All hands were saved, luckily.

Now, had the sluices been open, the engineers would soon have detected the leak, and the ship could have been got back to the Elbe and beached; or the influx of water might have been kept under by her pumping power.

In case of collision, or striking a rock, you would probably know the certain locality of a leak in a few minutes, and could at once close the sluices if she was sinking. If the leak was only small, and the sluices large enough to carry off the water, of course they would be left open. To ascertain this, keep sounding the compartment *with the sluices full open*, then if the water rises fast shut them at once.

NOTE.—Sluice valves or cocks are not now allowed to the collision bulkhead; and if the after-peak tank is used as a ballast tank no sluice valve or cock may be fitted in the after bulkhead. Only when it is not used as a ballast tank, and no pump is fitted to it, a valve or cock is allowed in the after bulkhead. All sluice valves and cocks must be arranged so as to be *at all times* accessible.

But there are cases where the sluices kept open might save the ship even when the leak let in more water than would run through the sluices. Thus, suppose the vessel was seriously damaged in the No. 1 or fore hold, and that you were running to beach the vessel on a shore three miles distant. In this case, if the sluices were kept shut, the fore hold would probably get full of water, and sink the vessel, or else so much would get in before you reached the beach as to make your ship unmanageable. Therefore, it would be advisable to open all the sluices, to allow the water to run as much as possible to the engine-room.

Of course if the water was rushing in so rapidly as to endanger life, then shut the sluices, and out boats, for life is the first consideration.

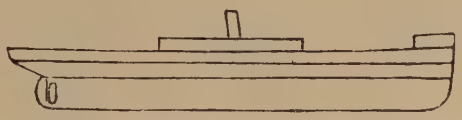
Steamers may be roughly divided into four classes:—

1. Three-decked ships, such as large mail and similar steamers.
2. Spar deck vessels.

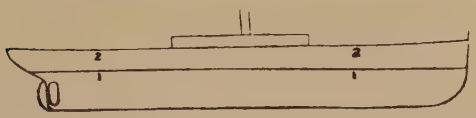
3. Awning deck vessels.

4. Single-decked vessels with erections.

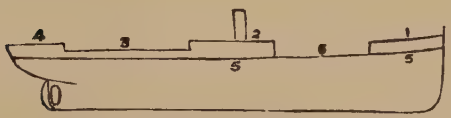
(There are single-decked vessels without erections, but they are not common.)



Three-decked steamer with top-gallant forecastle and bridge.




Spar-decked steamer with bridge. 1. Main deck. 2. Spar deck




Single decked steamer with erections, a "well decker." 1. Forecastle. 2. Bridge. 3. Raised quarter-deck. 4. Poop. 5. Main deck. 6. Well

Single decked steamer without erections. 1. Engine-room casing

The modern cargo boat. 1. Forecastle and bridge in one (closing up the well). 2. Raised quarter-deck. 3. Poop.

Single deck steamer with bridge, poop, and top-gallant forecastle.

The figures shew the ordinary types, and give the names by which the erections are known.

A "Three-Decked Vessel" does not imply that the vessel has only three decks, but is a term used to signify that the vessel referred to is built with full scantlings and suitable to carry heavy cargoes up to the upper deck of the three.

A "Spar-Decked Vessel" is somewhat similar to a three-decked vessel, but the deck and side plating above the main deck is not up to the same strength as the latter.

The freeboard is measured from the spar deck, but is of a greater amount than that allowed for vessels built under the three deck rules.

An "Awning" or "Shelter-Decked Vessel" is of still lighter construction above the main deck, and although the space between the main and awning deck is enclosed at the sides, the same amount and weight of cargo must not be carried there, but it is more suitable for the accommodation of passengers and cattle.

The frames of the vessel extend up to the awning deck itself, but if any superstructures are built on that deck then additional strength must be supplied.

There is a class of vessel known as a "Shade-Decked Vessel," but this deck is there mainly for the purpose which its name implies, and the space between main and shade deck is not enclosed at the sides.

*Plate No. 121a* illustrates the midship section of a large passenger steamer, similar to that whose profile is shown in *Plate No. 121*, and in addition to the naming of the various decks it will convey a further idea of the construction on the cellular double bottom principle.

With reference to the shell plating, frames, floors, etc., Section No. VIII*a*. has dealt with them in a general way.

The stern framing of a steamer must necessarily be considerably strengthened to withstand the extra strains put upon it and the component parts around it, owing to the working of the propeller or propellers *(see Plate 122a, Fig. 2)*.

The actual point of resistance due to forcing the steamer ahead does not fall upon the stern frame or stern tube, neither does it fall upon the engines. It is taken up by the "Thrust Shaft" and Block which are a little abaft the engines *(see Plate 122a, Fig. 4)*. These have to be kept cool by artificial means owing to the excessive friction, and jets of cold water are played upon them continuously while the engines are working.

Many attempts have been made in the past, and will be continued in the future, to get holds as clear for cargo as possible, so as to avoid broken stowage, and obstacles such as pillars, which are also a trouble when loading or discharging, have been dispensed with wherever possible.

Compensation must, however, be made to keep up the standard of strength, and *Plate No. 122, Fig. 1* will partly illustrate how this is done.

Reduction in the accumulative weight of material used in the construction of a vessel is a great consideration, for with every ton

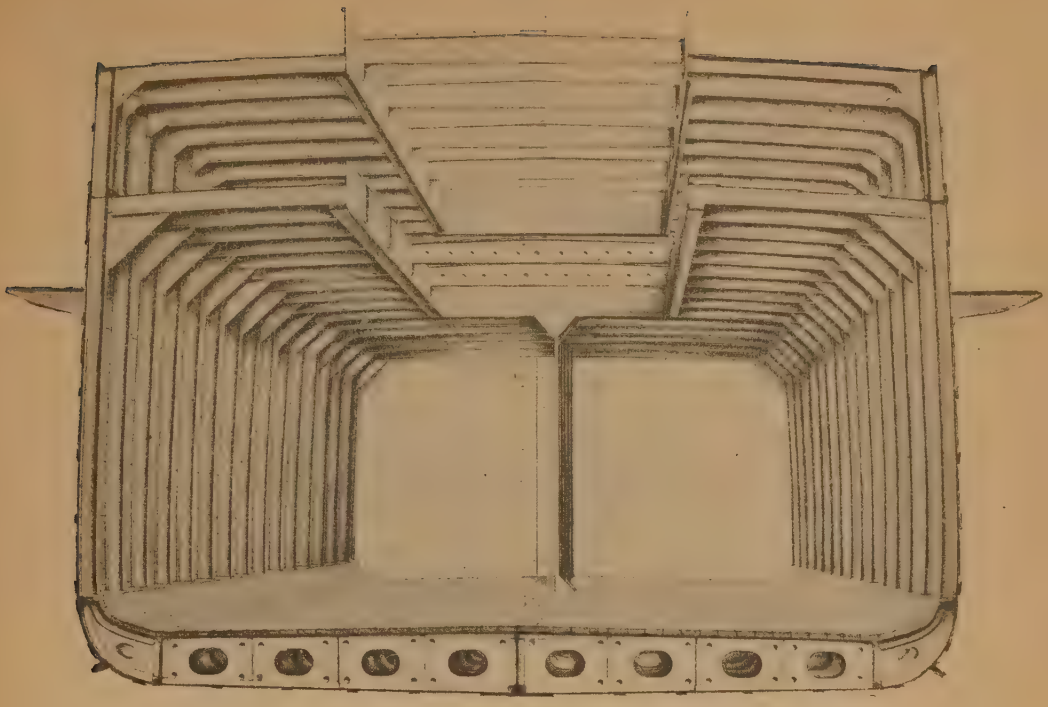


*Plate No. 122, Fig. 1.*
MIDSHIP SECTIONS SHEWING MODERN CONSTRUCTION
*By permission of Wm. Doxford & Sons, Ltd.*

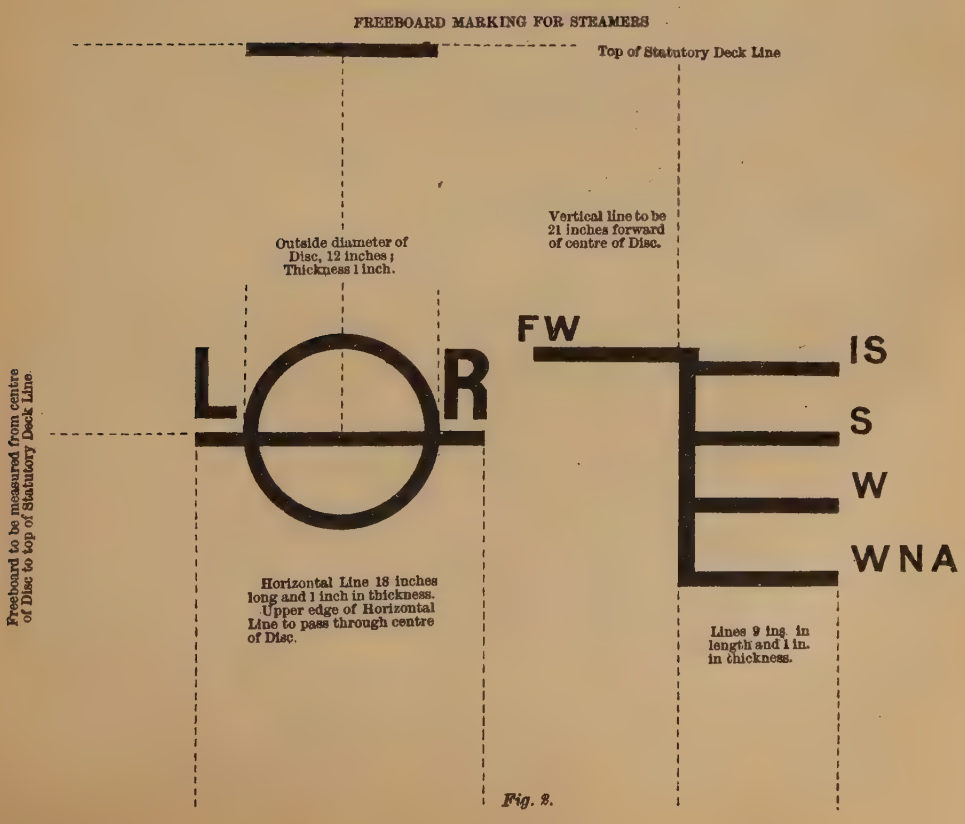
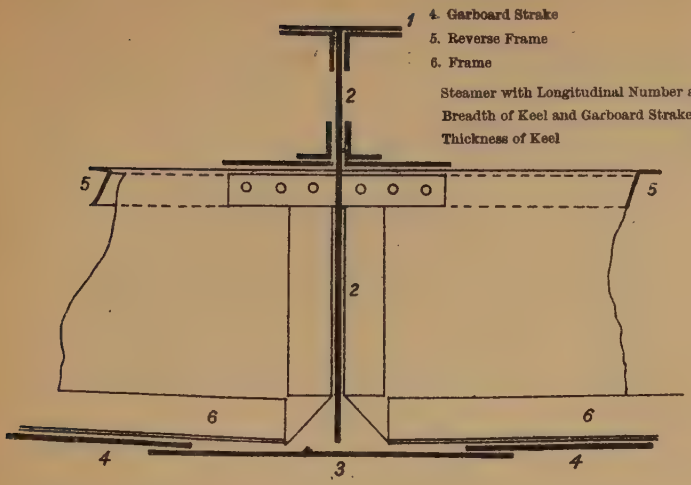

FREEBOARD MARKING FOR STEAMERS
Top of Statutory Deck Line
Outside diameter of Disc, 12 inches; Thickness 1 inch.
Vertical line to be 21 inches forward of centre of Disc.
Freeboard to be measured from centre of Disc to top of Statutory Deck Line
L
R
FW
IS
S
W
WNA
Horizontal Line 18 inches long and 1 inch in thickness. Upper edge of Horizontal Line to pass through centre of Disc.
Lines 9 ins. in length and 1 in. in thickness.

*Fig. 2.*

*Fig. 1.*

1. Rider Plate
2. Centre through Plate Keelson
3. Flat Plate Keel
4. Garboard Strake
5. Reverse Frame
6. Frame

Steamer with Longitudinal Number about 36.000
Breadth of Keel and Garboard Strake = 48 inches.
Thickness of Keel = 1 inch.



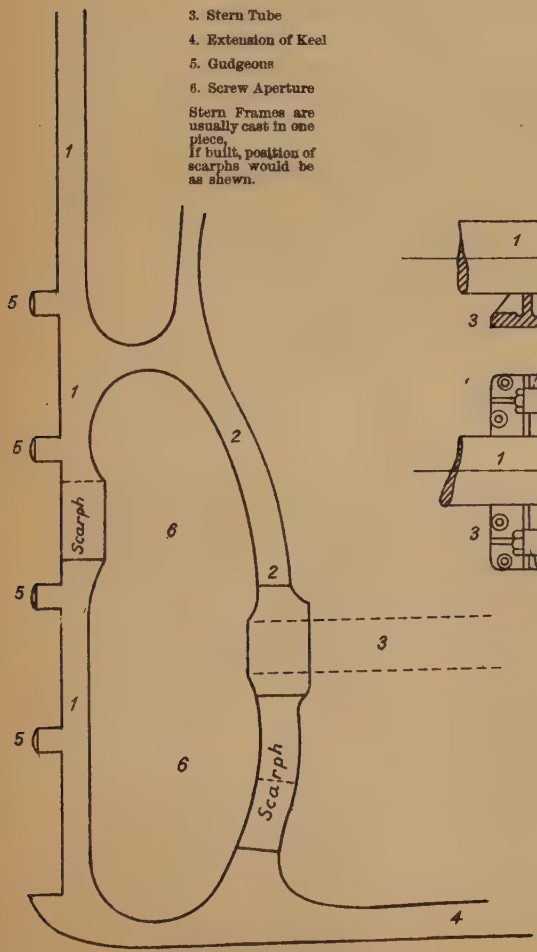

Flat Plate Keel with Centre Through Plate Keelson.

*Fig. 3.*

*Fig. 2.*

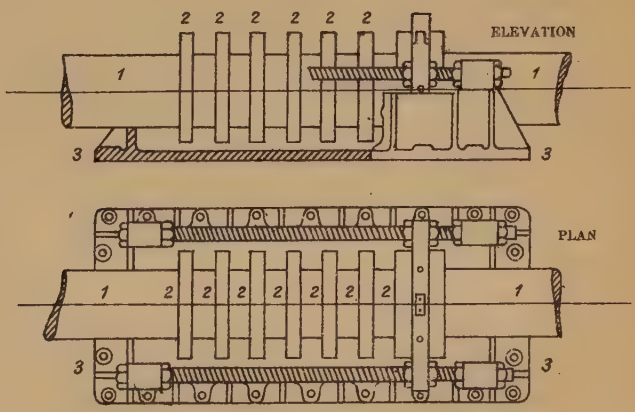
1. Rudder Post
2. Body ,,
3. Stern Tube
4. Extension of Keel
5. Gudgeons
6. Screw Aperture

Stern Frames are usually cast in one piece.
If built, position of scarphs would be as shewn.




Stern Frame of Screw Steamer.

*Fig. 4.*




HORSE SHOE THRUST.

1. Shaft
2. Collars
3. Thrust Block

GENERAL VIEW OF A STEAMER'S BRIDGE.

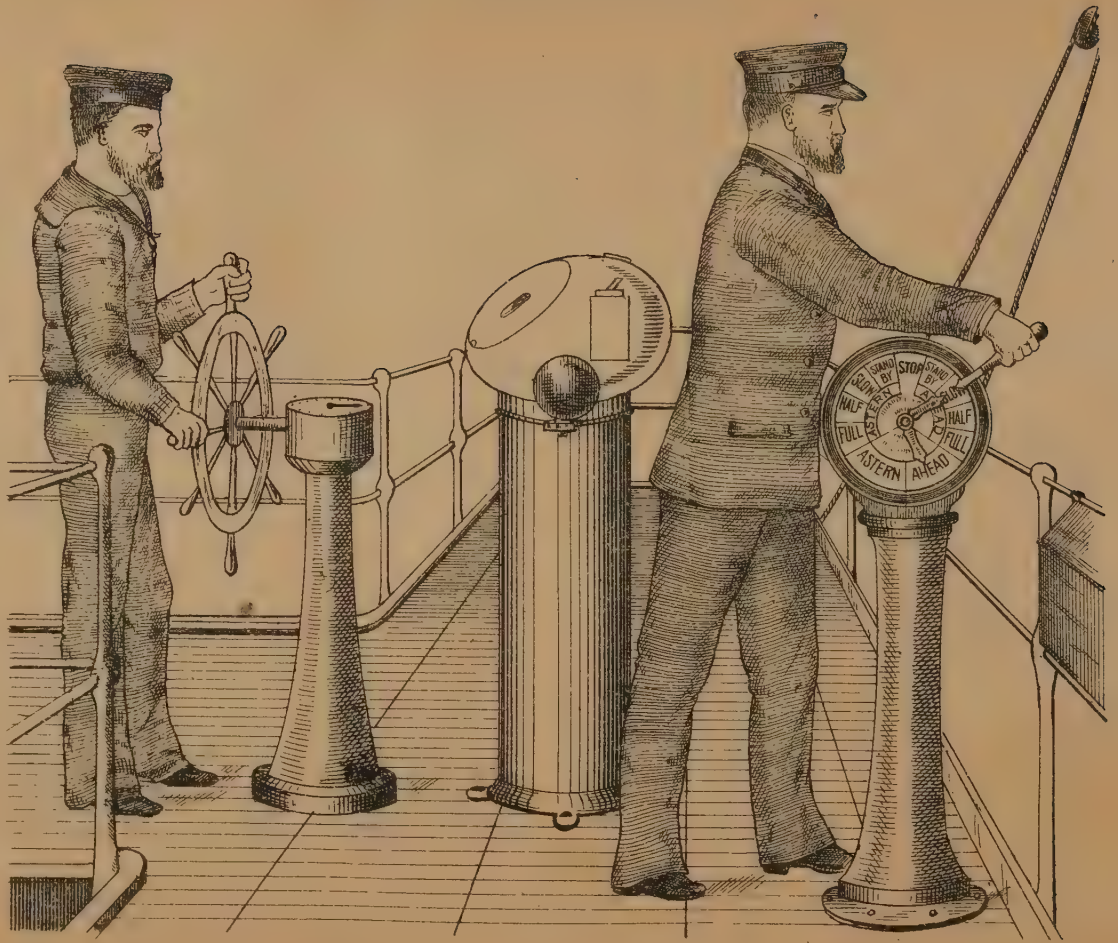



*Plate No. 133.*

saved in this direction an additional ton of cargo can be carried; provided of course that the "Rules" are complied with.

Liners between frames and shell plating have been omitted in many steel vessels, and a system known as "joggle plating" adopted.

By joggling the laps of the plates, as shewn in *Plate No. 122a, Fig. 3*, the outer strakes of plating have been brought into direct contact with the frames; even the length of the rivets are reduced, as there are only two thicknesses of plates for them to connect up, whereas when liners are employed there are three.

Referring back to Section VIIIa. we mentioned the placing of butt-straps on the hold side of the ship, where the ends of the plates meet. Now we can go a little further and mention that these are often dispensed with, and instead of bringing the ends of the plates edge to edge they are well overlapped and rivetted together.

It is a very good plan to read up these points on ship construction, and make notes of cases not quite understood, and when the opportunity presents itself, walk along a dock side and study the hulls of the various vessels moored there. Find the "Oxter" plate.

Amidships, usually at the fore end of the bridge-house, is "The bridge," from which the vessel is navigated; here, or in the wheel-house immediately beneath, is the steering wheel, the standard compass, and the engine-room telegraph, with, in ships of the highest class, a helm indicator. *(Plate No. 123.)*

The engine-room telegraph should be placed with its faces fore and aft, and with the "Ahead" portion forward. This communicates with the engine-room, and by it orders are given to the engineer in charge, who answers back all orders given, to show he has received them. The young officer should be very careful not to give a wrong order. Some years ago a large mail steamer was mooring to a buoy at Gravesend, the bow chain was secured, and the pilot gave the order "That will do with the engines." This is usually done by giving a ring or two on the gong, and leaving the pointing hand at "Stop." Instead of this the officer at the telegraph left it at "Full speed astern." The engineer hearing all the ringing thought it was a case of emergency, and started astern at once; luckily the pilot saw the mistake in time to prevent further accident than the parting of the cable.

A speaking tube to the engine-room, as an auxiliary means of communication, is a very handy thing, but is not always fitted.

Cargo work in steamers is always done by steam winches and derricks, with, usually, chain gear. In some trades rope is used, and when a steamer has to discharge general cargo in a roadstead where she is

rolling all the time, it will be found better to work out the cargo with manilla falls *held on* over the outer barrels.

Winches and pipes require care in frosty weather. When very severe it is sometimes necessary to keep them turning over very slowly all night, to prevent the pipes and cylinders freezing up. If the pipes *have* got frozen, the stop-cock from the boiler must only be opened very slightly till they are clear; if opened out full, suddenly, a burst pipe will be the result.

If the winches are used for hoisting sails, care must be taken to stop the winch before the leaches come taut, and to go very easy; if not, the leach-ropes will most likely be carried away, as the winch driver cannot tell when a little extra strain comes on the winch.

In preparing for sea in a steamer, the draught of water should be taken when the loading is finished. The derricks should then be sent down, and hatches and ports secured. The steam steering gear should be tried hard over each way, and the helm should be watched at the same time, to see that it answers to the movements of the machinery. The telegraph should then be tried, an engineer answering from below. The night glasses should be cleaned and put in their place on the bridge. The side and masthead lights and stern lights should be inspected, and lighted and put in their places, and the binnacle lamps also, before the vessel moves from the wharf. The lanyard of the steam whistle should be passed along, and the whistle given a trial blow. The boat which is used should be seen all clear for lowering, the plug in and cover off, and painter passed along. Care should be taken that there is nothing hanging over the side which can foul the screw, and all fenders should be hauled aboard before the vessel moves from her berth. Have log and lead-lines ready in their places, the hand-lead bent on, and the patent log oiled and in its place. As soon as the vessel moves from the wharf, or if possible, before, get an anchor over ready for instant use. It is a good plan also to give the engines a trial turn over, ahead and astern, if it can be done. The second mate, whose station is aft, must be very careful that his after mooring ropes do not foul the propeller when being hauled in; if there is the slightest danger of this, he must hail the bridge *instantly* to stop the engines.

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## TWIN SCREW STEAMERS.

Twin screw steamers are no longer a rarity, in fact they are ever growing in number, and not even confined to large vessels. Where speed is a required factor in a steamer, twin or even three propellers are frequently used.

Before dealing with the advantages let us get over one of the only disadvantages, and that is, projecting as they do, frequently beyond

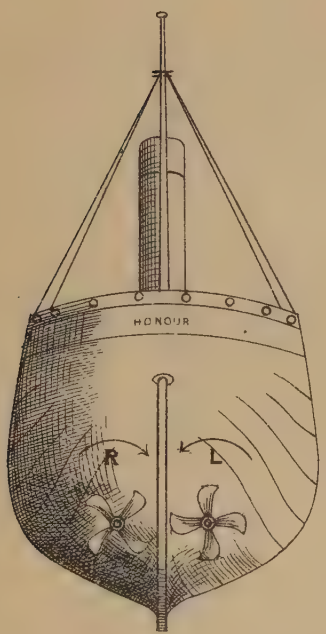
the sides of the ship, they are more liable to damage, and great care must be exercised in their use when near dock and quay walls.

The advantages are many; minimising the risk of total breakdown, the ability to stop one set of engines at any time to tighten up, etc., etc.; less wear and tear on machinery, for the force and power required is divided between two shafts, two propellers and two sets of engines.

With very large steamers they become almost a necessity, for such steamers as the *Aquitania* could not get sufficient power, with

*Plate No. 123a.*

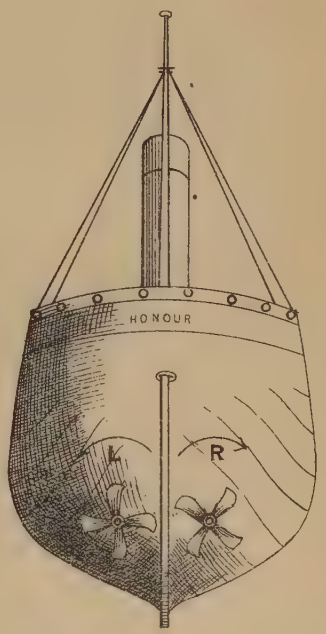
*Fig. I.*




*In-turning*

In this vessel R is a Right-handed screw. L is a Left-handed screw. Ahead on R and astern L, ship will turn head to Starboard and will turn nearly on her own centre.

*Fig. II.*




*Out-turning*

In this vessel R is a Right-handed screw. L is a Left-handed screw. Ahead on R and astern on L, ship will turn head to Port, and will turn nearly on her own centre.

safety, from one shaft and one set of engines The easier handling of a twin screw over a single screw steamer is a great consideration fewer tugs being required

In nearly all twin screw vessels the two propellers work outward as in Fig. II., that is to say, the upper part of the starboard propeller is passing over from port to starboard when going ahead, and from starboard to port when going astern. For the port or left handed propeller the order is reversed.

Now I do not think that it is generally known that a twin screw vessel with outward turning propellers, turns more easily with one engine going ahead and the other going astern than would a vessel with inward turning propellers

Referring to Fig. II. and imagining that we are going to turn that vessel round with her head to starboard. The order would be, astern on the starboard engine and ahead on the port.

The lower part of the starboard propeller is now passing from port to starboard, and being deeper in the water has a tendency to pull the stern to port.

Ahead on the port and the lower part of that propellor is also passing from port to starboard with the tendency to pull the stern to port. The combined action will therefore assist in helping the vessel's head to go to starboard, and this starting off from a stationery vessel will of course be more effective than when a vessel is making way through the water and under helm power.

Turn the vessel round to port and watch the two lower parts of the propeller, each passing from starboard to port, combined action again.

Now try the Fig. I. vessel, and you will find that although ahead on one and astern on the other brings the propellers working in one direction, they are influencing the stern against the interests of the direction in which you wish to turn the vessel's head, having a tendency, however minute, to pull the vessel sideways.

Twin screws being smaller than a single screw, the effect of upper and lower of the propellers, due to different depths of water, become greatly lessened.

When turning a twin screw steamer round from a stationary position, and in as small an area as possible, don't forget that the propeller going ahead must be at a rate of fewer revolutions than that of the one going astern, or the vessel will make headway.

The greater the beam of the vessel the greater the distance between the two propellers, and consequently the easier she will be to turn.

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## ISHERWOOD SYSTEM OF SHIP CONSTRUCTION.

During the last three months of the year 1908 there were launched six ships aggregating 31,608 tons deadweight carrying capacity, and these ships were of an entirely new method of construction. During 1912 the amount of tonnage launched of this type of build had increased to 1,777,348 tons, and for 1916 the figures had run up to 4,666,000 tons.

At the present time 60 to 70 per cent. of the vessels building in the U.S.A. (iron or steel), and taken over the past three or four years 95 per cent. of the worlds' oil tankers built, and now being constructed, are on this new principle.

Now these figures speak for themselves, and as the British shipowner has a wide reputation for adopting new ideas when they are to his interests to do so, we may take it that this new type of ship is worthy of consideration.

*Plate No. 123b.* illustrates the interior of a cargo steamer constructed on the Isherwood system, and we are indebted to the inventor for its insertion in this work. As the length of ships increase it is quite evident that the longitudinal stresses increase correspondingly, and the old type of construction does not allow for this.

The Isherwood type, instead of having the usual frames and reverse frames spaced two to three feet apart, are fitted with widely spaced

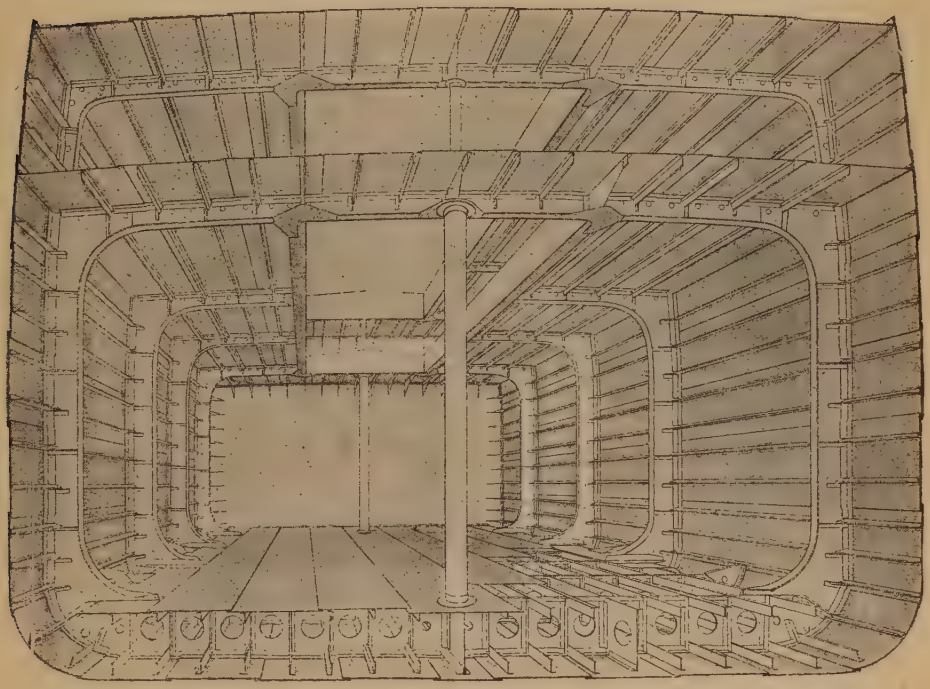

*Plate 123b.*

transverse members about twelve feet apart, each member being of a strength not less than the combined strength of the several frames that it replaces. Running fore and aft are a series of longitudinal frames and beams placed about thirty inches apart, the lower frames of an 8,000 ton ship, as illustrated, being of ten-inch bulb angle decreasing to seven inch at the upper part of the ship where the water pressure is less. Not only has additional strength been acquired but the weight of material is between 8 and 14 per cent. less, depending on the type of vessel, with the result that a greater weight of cargo can be carried.

The hold of the ship is also much clearer for bulky cargo than the older type allowed for, although there have been improvements in

other types of ships that aimed at the same avoidance of broken stowage.

Both the transverse and longitudinal frames are rivitted directly to the shell plating of the ship, which gives additional strength, absence of vibration, and the elimination of packing or liners that are so much in evidence in older types of vessels.

Another important item is the greater security against hogging or sagging which a large ship with such great longitudinal strength offers when having been so unfortunate to take the ground.

Referring to vibration we may add that the cost of maintenance for wear and tear is very much due to this and any diminution of such an important factor has far reaching effects.

The enormous rush for shipbuilding that will take place during the next few years will no doubt bring forth further improvements, and the writer has in his mind at the time the launching of a ship on July 1918, whose plates were connected together by electric welding in lieu of rivets. This being the first of such type, it is too early to go into it as a matter of seamanship. It is interesting to note, however, that the Isherwood system is playing a very prominent part in the electric welding experiments now being carried out in the U.S.A.; it being generally agreed that this system offers many advantages over the old in regard to the application of electric welding to ships.

## SECTION XXXIV.

## DUTIES OF OFFICERS IN A FIRST-CLASS MAIL STEAMER.

In these vessels the duties of the ship are usually apportioned as follows:—

The chief officer is in full charge of the vessel generally, and directs all work of every kind.

The second officer is the navigating officer.

The third and fourth officers assist generally, unless they too are allotted certain specified duties.

Their watches are three—except in the Atlantic trade, where watch and watch is the custom, two officers being on deck together—being arranged as follows:—

Chief officer, with him the fourth officer, from 4 A.M. to 8 A.M.

Third officer, 8 A.M. to noon.

Second officer, noon to 4 P.M.

Fourth officer, 4 P.M. to 6 P.M.

Chief and fourth officers together, 6 P.M. to 8 P.M.

Third officer, first watch. Second officer, middle watch.*

* When nearing port, however, or in places where there is a heavy traffic, it is usual to keep watch and watch.

## THE CHIEF OFFICER.

During the morning watch he directs the washing of decks, cleaning of brass-work, wiping down bright work, and seeing everything cleaned up, if possible, before the passengers appear on deck. To this end he will in fine weather leave the fourth officer in charge of the bridge, only seeing that he takes azimuths when the sun appears, and also morning sights.

He will see that the carpenter opens any scuttles that may have been closed during the night, if it is possible to do so, especially in the third class berths; and that on the proper days, at *least* once each week, all the sluices and cocks under his charge are oiled and screwed full out and in; that the water-tight doors in the bulkheads (in the passages) are shut and opened again to see that they work easily; and that all the clutch handles work easily. These are most important duties, and should never be neglected for *any* reason. The carpenter should also sound all the wells, and report whether there is any water in or not, at the same time entering it on the board in the engine-room.

The decks should be done by 8 A.M., or before traffic begins on the second and third class decks. Holystoning is an unmitigated nuisance to passengers, and the only wonder is that it has been borne so long and quietly by them. If the vessel has teak decks it is not needed on a voyage. By far the best way is to wet the decks down first (which should be done by the middle watch just before eight bells), and then set to work and scrub them with sand and brooms, then wash down, dry off with squeegees, and before they are quite dry sprinkle them again with sand. Get this done by about 7.30 A.M. Between this time and breakfast there will be considerable traffic about the decks, which will tread the sand about and be as good as another scrub. When the passengers go down to breakfast this will be dry, and can be all swept up again, and the deck will then be clean and dry.* If now, when the passengers go down to dinner, and again to tea, the decks get a good sweep down, the ship will not need a holystoning the whole passage, unless it be in the alleyways, which, owing to the presence of the ash-shoots, butcher's shop, scullery and galley, will of course be the dirtiest part of the ship. Great strictness as to cleanliness in this part of the ship should be insisted on, especially about the ash-shoot. This will probably not be attained without some trouble, and punishing an offender or two; but one or two men, be they cook, fireman, or what

* The great object is to keep the decks dry and clean in dry weather and in damp or wet weather to keep sand on the decks.

not, brought up sharp with a round turn at the beginning of the voyage, will generally be sufficient to keep things right in this particular. Brass work should be cleaned as soon as the decks are washed down, and for this purpose it is both economical and cleanly to have polishing paste among the stores, in lieu of the beastly mixture of oil and brickdust which in some trades rejoices in the name of "gumption." This scratches up the surface of the brass, and on any but a perfectly dry day causes it to dull again almost immediately after it is cleaned; whereas if polish is used, and the brass be polished up quite dry, it will keep its brightness much better. At eight bells the chief officer should be ready to make his morning report to the commander, and for this purpose should have the azimuth or amplitude and morning sights worked up for the ship's position and correction of the compass. (Of course it is assumed that the officers of a ship of this class are navigators worthy of the term, and do not have to wait till noon before they can get their vessel's position.) With this will also go the reports which may be customary in that particular trade which the ship may be in. The boatswain will now require his orders for the work to be done; the carpenter—who in this class of vessel is directly under the chief officer's orders, and not, as in ordinary sailing ships, under those of the master—will also have his special directions, and also the quarter-master who is not at the wheel. After breakfast the chief officer will take further sights if necessary, and get his work so far in advance that he will not require to do any further calculations at noon, but will, as soon as the Mer. Alt. is worked, have his Longitude at noon also, without having to go to his berth to work it out. He will now be able to take a little leisure until it is time for the general daily inspection of the whole ship, in company with the captain, doctor, and purser. This over, the rest of the morning up to noon will be spent in general direction of the work of the ship, of which every day brings its share. Noon being past, and the ship's position marked on the chart, the *principal* part of the chief officer's work is over for the day. There will, however, be the log to write up, in which most careful entries should be made as to sluices, wells, boats clear, and so on. The second officer will now be in charge till 4 P.M., and unless there is any reason against it he will be relieved by the fourth officer. At 6 P.M., however, the chief officer should come on deck, or before that if dark. Between this and eight bells he will receive the usual reports for the night. The boatswain will report the boats clear for lowering, and everything in his department in order; the carpenter that the fire-gear is all

ready, and that the sluices, &c., are in order, and the wells sounded, also what scuttles have been left open in the passengers' quarters, and so on.

At eight bells he will, unless it is inadvisable to leave the bridge, go aft, make his report to the captain, and receive orders for the night, with the order book, containing course to be steered, &c., &c. If necessary, the fourth officer will perform this duty, in which case the chief officer will remain in charge of the bridge with the third officer until relieved by the master, or till he finds it unnecessary to remain longer. He should not, however, turn in until he has been the round of the vessel, and seen for himself that everything is right.

The second officer is the navigating officer. He should be on deck soon after 8 A.M., to take morning sights and observations for azimuths. These should be worked up, and the ship's position got as accurately as possible since the stellar observations of the previous night. He should also prepare his sights for noon, so that the lat. and long. may be had *at once* when the sun dips. If cloudy weather, he will of course look out carefully for a glimpse of the sun for double altitudes, and, especially near noon, for an ex-meridian. He will keep careful record of compass observations, as well as the geographical places where magnets were changed, their positions, &c. (of course he will never touch these himself without orders from the commander); and in a foreign port will be careful to get good deviation curves when the ship swings. During the afternoon he will take P.M. sights, and send them aft by the captain's steward, also azimuths, when the sun reaches a suitable position. In the middle watch he will always have the ship's position and compass correction from stellar observations or alt. of the moon. He has charge of the baggage, and on baggage day will have to be in attendance in the baggage-room, and endeavour to satisfy the oft-times trivial wants of the passengers to the best of his ability.

The third and fourth officers have their watches to keep, and attend to such duties as fall to their lot in the particular trade they may be in. They will both work up sights and have them ready for inspection at noon.

The second, third, and fourth officers have each charge of a cargo hold, and are responsible for the taking in, stowage, and discharge of the cargo; and, unless special provision is made, will have to keep tally also.

The mails should be in the purser's charge, the officers having nothing to do with them beyond superintending the taking in and discharging of them. The purser also makes out the manifests, and

does all work connected with the articles and men's wages, and is also head of the cook and steward department.

Boat-drill should be practised before sailing, and there should be fire and boat stations on a certain day every week, when particular notice of any seeming defects should be noted and remedied.

Look-out men should be made to hail the cat-head, or call "All's well," every half-hour when the bell is struck, and the condition of the lights should be reported by them or by the boatswain's mate at the same time.

The watch on deck should not be allowed to go below till the other watch are on deck, but *each* watch should be mustered on its own side of the deck, in front of the bridge, at each change of watch.

The chief officer should always consider himself as in *full* charge of the ship, and whatever officer be on watch, his personal responsibility does not cease unless he is relieved by the commander himself.

In the Atlantic lines the duties of officers are somewhat different. For instance, the watches are always double, two officers being on watch at the same time day and night: the proper arrangement being chief and third officer together, and in cases of any emergency, captain and second officer, with them the fourth officer. The times of watch are the ordinary watch and watch routine.

The work is also different, the steerage being usually washed down by the middle watch, the morning watch taking the upper decks.

The officers have their own mess-room, never taking their meals with the passengers. This arrangement is made necessary by the watch and watch system, and also by the large amount of bad and cold weather experienced. It would be most inconvenient if an officer had to divest himself of oilskins and wraps, and go through an elaborate toilet, and afterwards sit through a long dinner, out of the short time of his watch below.

With these exceptions the officers' duties are much the same as in southern-going mail services. Of course each different service has its different matters of routine, but the short sketch here given will serve as a fair picture of the officer's life and duties in the large mail and passenger lines.

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This section concludes with an example of a Mail Steamer's Log.

**Royal Mail Steamship**

*From*

*Day of the Week* Monday

| *A.M.* | *K.* | *F.* | *Courses.* | *Winds.* | *Bar.* | *Ther.* | | *Look-outs.* | | *Rev.* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Air.* | *P. Log* | *Name.* | *From* | |
| | | | *Bridge. Tripod.* | | | | | | | |
| I. | 12 | 4 | S.36°W. S.37°W. | N.E. | | | | Desmond | 12 2 | |
| II. | 12 | 4 | | | | | | | | |
| III. | 12 | 4 | | | | | | Little | 2-4 | |
| .V. | 12 | 4 | | | 30·23 | 74° | 112′ | | | |
| V. | 12 | 4 | | N.E. by N. | | | | Atwal | 4-5·30 | |
| VI. | 12 | 4 | | | | | | | | |
| VII. | 12 | 4 | | | | | | | | |
| VIII. | 12 | 4 | | | 30·22 | 75° | 265′ | Water in | Holds. 6 a.m. | 6 p.m. |
| IX. | 12 | 4 | | Draught | on Ar | rival. | | F. Comp. | 1 in. | 1 in. |
| | | | | For. | 18 ft. | 0 in. | | No. 1 | 3 in. | 3⅓ in. |
| X. | 12 | 4 | | Aft | 18 ft. | 8 in. | | ,, 2 | 1½ in. | 1½ in. |
| | | | | | | | | ,, 3 | 3 in. | 3 in. |
| XI. | 2 | | | | | | | | | |
| XII. | | | Anchored Las Palmas. | | | | | Ballast Tank | Empty. | |

| *Noon* | *Course.* | *Distance.* | *Diff. Lat.* | *Dep.* | *Lat. D.R.* | *Long. D.R.* |
|---|---|---|---|---|---|---|
| | Anchored | in Las Palmas. | | Received | 5,000 Galls. F. | Water. |

| *P.M.* | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| I. | | | | Nly. | | | | Fresh water | 6 a.m. |
| | | | | | | | | Star Wing Tank | 2 ft. 3 in. |
| | | | | | | | | Port ,, | 7 ft. 3 in. |
| II. | | | Las Palmas Anchored. | Draught | leaving. | | | Star Mid Tank | 5 ft. 0 in. |
| | | | | For. | 18 ft. | 6 in. | | Port ,, | 2 ft. 6 in. |
| III. | | | | Aft | 19 ft. | 0 in. | | | |
| IV. | | | | | 30·23 | 79° | | | |
| V. | 4 | Com | mander's Orders. | N.E. | | | | 4·15—Received | 2 Bags |
| 55 | | | | | | | | of Mails for the | Cape, |
| VI. | 12 | 6 | S.36°W. S.35°W. | | | | | the same secur | ely |
| | | | | | | | | stowed in Mail | Room. |
| VII. | 12 | 6 | | | | | | | |
| VIII. | 12 | 6 | | | 30·18 | 71° | 27′ | | |
| IX. | 12 | 6 | | | | | | Jeal | 6·15-8 |
| X. | 12 | 6 | | | | | | Hayward | 8-10 |
| XI. | 12 | 6 | | E.N.E. | | | | Mannering | 10-12 |
| XII. | 12 | 6 | | | 30·20 | 68° | 88′ | | |

Commander.

*Towards*

*Day of the Month* July 10th *18* 91

| *A.M.* | *Remarks.* |
|---|---|
| | Quarter-master's rounds regularly made and reported all well. |
| 2·30. | Commenced to wash and scrub decks. |
| | Moderate wind and fine. |
| 5·15. | Lat. ⁎ 29° 2′ N. Long. ⁎ 15° 4′ W. |
| | Ship's Hd. S. 36° W. Comp. Err. 16° W. |
| | Var. 19° W. |
| | Dev. 3° E. |
| 7·0 | In all sail. Fresh wind and fine. |
| 8·45. | Obs. *Isleta* bearing S.W./W. 10·13.—*Sphinx* abeam ½′. Hauled in for anchorage. |
| 10·19. | Slowed engines. 10·23.—Stopped. 10·27.—Brought up in 7½ fath., with 45 fath. chain on star. anchor. |
| | Sanitary inspection of ship by Captain, Chief Officer, and Surgeon. |
| 10 40. | Received Pratique and delivered Mails. Commenced coaling. |
| | Steaming time—22 h. 26 m. 0 s. |
| | *Lights taken in at* Sunrise *A.M.* |

| *Lat. Obd.* | *Long. Chron.* | *Course and Dist.* | *Variation.* | *Bearing and Distance.* |
|---|---|---|---|---|
| Anchored Las Palmas, Gran Canaria. | | S. 19° W. 270 | 19° | From 5′ E. of Gando Pt. to 30′ W. of Pedro de Gallia. S. 18° 57′ W.—363. |

*P.M.*

| | |
|---|---|
| 3·30. | Finished coaling. Received 205 tons. 3·40.—Received stores. |
| 4·20. | Hove up anchor and secured it inboard. 4·32.—Slow ahead. |
| 4·42. | Proceeded full speed. Ship's Hd. S. 36° W. Comp. Err. 16¾° W. |
| | Var. 19½° W. |
| | Moderate wind and cloudy. 5.—Set square sail. Dev. 2½° E. |
| 7·15. | Maspalomas Lt. bore N.W. ¼ N. (mag.) 12′. |
| 7·30. | Fire-hose connected, and boats' falls clear. |
| 8. | Strong trade-wind and following sea. Fine weather. |
| 11. | Lights reported all out below, and rounds carefully made. |
| 11·50. | Passed steamer bound North showing Company's signal. |
| | Similar wind and sea. |
| | *Lights hung out at* Sunset *P.M.* |

## SECTION XXXV.

# DUTIES OF OFFICERS IN A COASTING STEAMER.

The first duty that demands the attention of a chief mate on joining a steamer employed in the coasting and continental trade, will depend very much upon the vessel's surroundings at the time he comes on board.

The writer hopes he may be pardoned for introducing the chief mate's duties in the following manner, and trusts the illustration will meet with the approval of his brother seamen.

Mr. Adam joined the steamer *Eve* at 10 A.M. on the 1st of the present month (she was lying under a coal spout, ready to take in a cargo of about 2,000 tons of coal, in a port on the N.E. coast of England), and reported himself to the master.

He, Mr. Adam, then went on deck and examined the moorings fore and aft, as the tide was running very hot, and ordered sundry alterations to be made with the ropes and mooring chains, &c., thereby introducing himself to the notice of the second mate and crew. Shortly afterwards he called the crew together, took their names, and recorded them in his pocket-book, and kept the men at work heaving the vessel fore and aft, as occasion demanded, in taking in the cargo.

He then went below and overhauled well the cargo book, to see what amount of cargo the vessel generally took in in each compartment, also he looked up the log-book, and entered the fact of his joining the vessel, and saw that it was properly written up to date. He next overhauled the vessel's store-book, to see if the proper amounts of oil, paints, cordage, &c., were on board requisite for the voyage, as the master had previously informed him that the vessel was bound to Bordeaux, and from thence to London with a general cargo.

As the cargo was coming in very fast, and to all appearance the vessel would be loaded at sunset, Mr. Adam had to bestir himself, for every moment that he could steal during the intervals of loading was of great value to him.

The next matter of importance he directed his attention to was the vessel's pumps, and different sounding pipes; and he made the carpenter muster all the gear connected with them, inspected it minutely, and worked himself the different sluice rods to see they were all in good order. He then informed the carpenter that he required him to sound the holds and bilges every four hours at sea, morning and evening in harbour, and also to always carefully sound the ship fore and aft

directly she got out to sea, AFTER LEAVING PORT; and to be careful and record it on a blackboard, hung in the entrance to the engine-room. As the carpenter walked away Mr. Adam thought he heard him mutter to himself the words "*mighty particular*," but as he was not certain about it, he said nothing.

Mr. Adam next went and overhauled the stores, to see they compared with the account in the store-book, and found all in good order. He then arranged matters somewhat hurriedly in his cabin ready for "sea fight."

He next overhauled the windlass, and all the gear connected with it, and stood by it whilst the carpenter oiled all its working parts. He then directed his attention to the cables, and inquired from the second mate if the shackles were properly marked their full length. Having received an answer in the affirmative, he next looked at the forelocks of the anchor shackles, and saw they were well secured by a ring, to prevent them working out. He then inquired from the second mate if his lamps and lead and log lines were handy, and the whole of the steering gear was in good working order and oiled, and took a turn round the decks, and examined them himself.

Then he went forward and overhauled all the hawsers, cork fenders, and heaving lines, &c. upon the fore deck, and finished off by taking a turn over the mastheads, to see all the running gear and sails were all a-taunt-o.

Mr. Adam's time was now fully employed in finishing off the loading of the vessel, with lamp in hand, as it had come on dark. He ordered the vessel to be trimmed to the required draft given him by the master, and when the cargo was all on board and trimmed, he saw the vessel was upright, and that the centre of the load-line disc was on a level with the water (not below it) on both sides of the vessel.*

The hatches were then battened down with double tarpaulins, and securely wedged, and when each hatch was finished Mr. Adam examined them, and saw they were secured to his entire satisfaction. So he then concluded his department was all in good order, and that the *Eve* was ready for sea.

Now the master had ordered the ship to be ready one hour before high-water, the pilot being ordered to be on board at that time, so Mr. Adam ordered all hands to be on board ready for work two hours before high-water, to enable the heavy moorings to be taken in, and the vessel hung in position by trustworthy slip ropes, all ready to slip at a moment's notice when the master and pilot came on board.

*Seeing of course that, with proper allowance for the density of the water where she was loading, the vessel was laden to her proper (salt-water) freeboard. See Plate No. 122, Fig. 2

All this was carried out at the appointed time, and in a few minutes after the master came on board the ship was under weigh.

Before getting out to sea the *Eve* had to pass through a long dock full of shipping, and in this dock were three narrow gateways and a long lock. The night being densely dark, the master informed Mr. Adam that he need not be frightened when the ship's head was about entering any of the above-named narrow gateways to inform him if the helm wanted porting or starboarding, or the engines to go ahead or astern as necessary, as he, the mate, must never forget on a dark night that he is situated 150 feet nearer an object ahead of the ship than the master is, therefore he is in a capital position to advise the master, in entering the ship's bow into a narrow gateway. Mr. Adam took the hint immediately it was given him, whispering to himself the words "Wise precaution," and he thought that had he done so in the last vessel he was in, how the master would have snubbed him! but consoled himself with the old sea saying, "Different ships, different fashions."

So he acted according to the directions given him by the master when entering the narrow gateways, and kept advising him when requisite, and although it was a bitter winter's night, as dark as the grave, the good steamer *Eve* passed out to sea without a scratch upon her broadside.

After getting to sea Mr. Adam had the anchors properly lashed and wedged on the forecastle, and the cables hove taut to the windlass, and had all the hawsers and harbour gear stowed carefully below and lashed. He then observed the log was oiled and properly set; and the decks being all cleared away, he took a good look that the boats' lowering gear was all in proper order, and the life-buoys and belts were in their respective places, ready for an emergency. At this moment it struck eight bells, and it being Mr. Adam's watch below, he considered he had got through a hard day's work very fairly, and turned in, concluding in his own mind that he had *faithfully done his duty.*

When Mr. Adam came on deck to relieve the watch, he found the vessel had passed Whitby. The master gave him the necessary orders how to steer, &c., and remarked, "Do not run lights fine, Mr. Adam," which, he presumed, meant to starboard if he saw a green light coming towards the vessel fine on the starboard bow, and to port if he saw a red light fine on the port bow; so he took the hint, and ever afterwards whilst he was in the vessel acted on it.

After getting the night orders from the master he saw the lights were all burning brightly, and as Whitby lights were still in sight he

stepped for a moment to the standard compass, and took the bearing of them.

When the vessel drew up towards Flamborough Head, he carefully took the four-point bearing of the light, and ascertained when he passed it that the vessel was distant therefrom 2 miles, that being the distance the master had ordered him to pass outside the light. He carefully noted this down on the log board, with the distance run from Whitby.

After running some distance southward of the Head, he began to find, by passing vessels' lights, that the weather was turning a little hazy, so he out watch and timed several vessels' lights in approaching his own vessel, and found, by a little mental calculation, that he could not see a coloured light over one and a half miles, so as this was somewhat risky work going full speed, and especially so if he unfortunately tumbled across a vessel with bad lights, Mr. Adam, like a prudent man, doubled the look-out and sent down and called the master.

The night was clear overhead up till now, but just before the master got on deck the vessel became enveloped in a dense fog in a moment. Mr. Adam jumped over and stopped the engines, and kept sounding the whistle. When the vessel's way was deadened through the water he put the telegraph at 'slow ahead.' By this time the master had come on the bridge and took full charge of the vessel, and after hauling her inside of the line of traffic, and frequently using the lead, as the fog continued very dense, he brought the ship up to an anchor, and set an officers' anchor watch.

Mr. Adam was informed by the master that the undermentioned rules were a standing order in the *Eve* at sea :—

No. 1.—Never pass a light at night, or a headland or sea mark by day, without taking a 4-point bearing of it, and recording the same on the log board on the bridge.

No. 2.—An azimuth to be taken whenever practicable on all long courses, night or day.

No. 3.—To call the master if the slightest doubt exists in making the land, or a light ; or if the weather turns hazy call the master immediately.

No. 4.—To note on the log board the distance run from point to point, or light to light, or, if out of sight of land, the distance run every 4 hours, with the courses steered by standard and steering compasses.

Mr. Adam found this a little irksome at first, for he had not had such work to do in the last coasting steamer he was in, but he soon got used to it, and he found out how *very useful* the four-point bearing and bridge log board were in coastal navigation, so he vowed to himself, when the day came for him to take charge of a steamer, he would carry out the same routine.

During the passage out to Bordeaux Mr. Adam had all the cargo gear well overhauled, as they had fine weather down the Channel and in the Bay of Biscay, and the *Eve* arrived all well at the mouth of the Gironde on the fourth day out, and received a pilot on board. Then Mr. Adam got the anchors off the forecastle, and saw all the windlass gear was in good working order before dark; and it was well he did so, for soon after the pilot came on board he brought the ship up in Richard Roads to await the flowing tide.

After the vessel was safely brought up Mr. Adam observed the riding lights were burning brightly, and that a relieving light ready lit in the lamp room was handy in case either of the riding lights went out, as the master's orders were two riding lights to be hoisted, one on each side of the lower rigging, one forward, the other aft, so that in case of a ship approaching the *Eve* the funnel could not shut out both lights, which might be the case with a single riding light. Mr. Adam knew that this was not in accordance with the Regulations for Preventing Collisions, but consoled himself with the old sea maxim, "obey orders if you break owners." * He then took the cross bearing by the standard compass of the Point de Grave and Richard lights, and dropped the 56 lb. lead over the side, and kept it on the bottom, so that the line could be felt every now and then to see if anchor was properly holding or not. As a strong spring ebb was running, the master ordered an officers' watch to be kept.

The log used on the passage was a Walker's harpoon, so Mr. Adam placed it in a bucket of fresh water, dried it by the fire, oiled it carefully, and stowed it away below.

Mr. Adam had always made it a rule, when picking up an anchor, to every now and then inform the master how the cable grew, so that he could manœuvre the vessel with the engines and helm to ease her up to the anchor. In the daytime he accomplished this by signs, and at night by a messenger, to avoid unnecessary shouting, which destroys the equanimity of everyone fore and aft on a dark night; so when the anchor was hove up just before dawn he acted as described.

In going up the river Mr. Adam had all the cargo derricks rigged, with all their attendant gear, so that, when the ship was moved in her

* The Revised Regulations require this.

discharging berth, the discharging could commence at once. In due course the *Eve* arrived all well at Bordeaux Quay, and commenced to discharge the outward cargo.

After the coals were all out, Mr. Adam had all hands down in the holds, sweeping and washing them out; he also had all the limber boards lifted and the limbers properly cleaned out, and was quite ready at the appointed time to receive the homeward bound cargo, which was principally composed of brandies and wines in casks and cases. He paid great attention to the stowage, and saw the casks were well supported on beds and quoins, bung up and bilge free, and returned several leaky casks; he was also very careful with the tally, or number of packages taken in. He gave the stevedore orders not to stow more than five heights of casks on top of each other, unless they were supported by temporary fit cross beams. As the *Eve* had no laid between decks in the forward holds, this important matter had to be strictly attended to. After the cargo was all in, the tally clerks on shore compared notes with Mr. Adam and the second mate, and found to their great satisfaction all the tallies exactly agreed; so as it was a very valuable cargo, Mr. Adam used extreme caution in entering the smallest details connected with the cargo in the cargo book, and was very careful when securing the tarpaulins to see they were turned in well at the corners, and made perfectly watertight.

At intervals, during the time the *Eve* was loading, Mr. Adam found ample time to paint the vessel round outside (as a stevedore's gang were taking in the cargo), and to touch up many things about the deck with the paint brush. He also had the masts scraped, and the funnel painted; and when the ship arrived all well in London, the *Eve* looked as if she had just been turned out of graving dock after a thorough refit.

The owner by chance happening to drop on board in London, and seeing, with some pride, his vessel looking so clean and smart, very naturally complimented young Mr. Adam upon it, for which the latter named gentleman politely thanked him, remarking modestly that he had simply *done his duty*. But the owner being a good meaning man, who had been at sea himself in the former part of his career, determined in his own mind that Mr. Adam was a promising young officer; so after keeping his weather eye lifting upon the young fellow for the next six months, concluded to promote him.

One day after the *Eve* had discharged a cargo of mineral in London, a short note was quietly dropped into Mr. Adam's hand by the master. He opened it, and to his great joy and surprise he was there and then

appointed to the command of a fine new steamer fitting out in the River Wear, and he had to proceed north as quickly as possible and join her. He quickly made out a store list of the remaining stores on board, filled in carefully his log and cargo book up to date, gave his master a quiet shake of the hand, and a look which expressed a heap of gratitude, packed up and left, and this was how it came about young Adam and the good steamer *Eve* parted company.

Before concluding these remarks about the duties of the chief mate, I would advise that, when young officers are appointed to a new vessel, whenever possible, they should be on board several days at least before the vessel begins to load her first cargo, to give them a chance to investigate the *internal* and external fittings of the vessel, especially so in these days of so many new patents.

Engineers as a rule are generally appointed to vessels in this manner, and it is nothing but just and proper that the deck officers should receive the same privileges. For the writer can speak from the experience gained in fitting out many new steamers, that when this was done it materially contributed to the comfort and safety of ship and crew on her first voyage, and saved the owners eventually a lot of money.

In whatever ship the young officer may be as mate, he should always remember that he is the captain's right hand man, and that in any case of difficulty with the crew, or in emergencies of any sort, he should take a prominent lead, and not be too particular about personal risk; unless he is fully prepared for this he will cut but a poor figure in such cases. The second mate and junior officers should also be instantly ready with their assistance under any such circumstances, and not be hanging back and letting others bear the brunt. It is often the case that through want of manliness and nerve, young officers fail in these matters, thereby instantly causing the master to put them down as useless lubbers and fine-weather sailors. A man may be a smart navigator and good at figures, but unless a smart seaman, and not afraid of a rowdy crew, he will never be thought anything of, and will probably be despised by crew as well as master. At the same time, though it is absolutely necessary to *enforce* proper discipline, it cannot be too strongly insisted on that brutality is one of the worst attributes an officer can have, and always shews a coward at heart and a blackguard. With careful tact, and by shewing a bold and decided front, a crew may in most cases be kept in order without resorting to personal violence, but when this is necessary the best plan is not to hesitate. One of the best specimens of a sailor the writer ever knew, who, though

a strict disciplinarian, was a religious man, and with no proclivities towards rough treatment, on one occasion thought it necessary to shoot one of his men to prevent a mutiny, which he did, and was greatly praised for doing so. Of course this is a rare case, and a proceeding not to be done thoughtlessly.

## THE DUTIES OF SECOND MATE IN COASTING STEAMERS.

The duties of this officer in coasting steamers depends to a great extent on the tastes of the individual master he engages himself to, and these tastes differ materially in different vessels; therefore no hard and fast description of his duties can be written. But to get over the difficulty as far as possible, I will cite the routine of this officer's duty that has been carried out for the last 25 years in one of the best and largest coasting employs in the north of England, and found to work very satisfactorily.

The class of vessels we are now alluding to are termed Weekly Boats—that means, their crews are engaged by the week, 24 hours' notice being required on both sides in the United Kingdom previous to the discharge of any member of the crew, and they find their own provisions. The seamen composing these crews are family men, who have long ago found out the virtue of a good home on shore, and have given up going long oversea voyages, and settled down for good in the coasting trade steamers; and as a body of good, trustworthy, sober men, their equals are not to be found in the merchant service of this country. The average all-round coasting second mate, with a crew of this description, can get through an amount of work in a day that would perfectly astonish the second officer of a pure and unadulterated Southern-going sailing ship, who had never been out of deep water vessels.

As I said above, these men find themselves with provisions, therefore no discontent ever arises in regard to their living; and I think most of my brother seamen will admit that in the foreign trade more discontent arises amongst seamen from this cause than from any other cause you could name. Therefore, through the force of circumstances, and the surroundings of his crew, the coasting trade second mate has, generally speaking, a willing lot of good, civil men, who well know their work, to help him to carry out the arduous duties of a coasting steamer. So as willing hands and light hearts can accomplish wonders at sea as well as on shore, the second mate in the coasting trade may be envied in this particular by the second officer of many a South Spainer.

Our second mate, then, takes charge of all the deck gear, from the bridge to the after end of the vessel, and his watch work that end of vessel in and out of harbour. If a boat is required in harbour to run away hawsers, &c., a man is taken out of each watch to man her (for you must remember nowadays the 2000 tonner only carries six A.B.'s in the coasting trade).

He also takes full charge of all the steering gear, and is held responsible for its safe working, and oils and works the steering engine himself preparatory to getting under weigh; putting the helm hard over both ways several times, to clear the engine of water, and to prove the chains are clear, and the rudder works correctly.

Also lead lines, log lines, blue lights, and rockets are under his especial charge.

All signal lamps, masthead, side, and anchor lamps he is responsible for; and as the 2000 tonner carries no recognised lamp trimmer nowadays, the second mate receives a small sum per week for doing, or rather seeing, lamp trimmer's duty performed. As he sometimes has not the opportunity to trim the lamps himself, he is compelled to let one of the seamen do it; however, he supervises the operation afterwards, and in harbour tends to them very often personally, as the master holds him alone responsible for the trimming and burning of the vessel's lights.

He has also charge of all paints and oils on board, and has to deliver to the mate, at the end of each voyage, a list of the amount of oil consumed on the voyage, and the remains; also the consumption of paint, &c., with the remains, which he records in his store book every voyage.

He has nothing to do with the cordage stores, the chief mate asserting his prerogative in that department.

One of the second mate's chief duties is, on entering or leaving port, to place himself in a suitable position aft, and keep a bright look-out that nothing gets foul of the propeller, or if anything is likely to foul it (before it actually does so), especially at night time, to give the master timely warning. A smart officer aft, when squeezing out between tiers on a dirty, dark night, is worth his weight in five-pound notes to the master; of course I mean a man who sees a little before his nose, and who never forgets he has a tongue in his head, and when the occasion demands, knows how to use it.

He keeps watch and watch with the chief mate, as the master in the coasting trade sleeps when he gets a chance; independent of whose watch it is on deck—*his* duty is to be on deck in narrow waters; so it often happens in the second mate's watch on deck the vessel is in open

water, not requiring the master's presence on the bridge; and in the mate's watch the vessel has to pass through a narrow channel like the Downs or Yarmouth Roads, where the master's presence is compulsory; therefore he keeps no watch strictly speaking. *Any watch* is his watch when the vessel is in narrow waters.

What the foreign going officer would term intricate navigation or narrow water, the coasting trade officer would call open water; therefore great distinction is necessary when describing the watches in the two separate classes of vessels.

In keeping his watch at sea the second mate acts precisely in the same manner as the chief mate, therefore a repetition of this deck duty is quite unnecessary, being well described under the heading of the duties of a chief mate.

In entering roadsteads the second mate takes the soundings, and remains about the bridge near the master, ready to carry any orders to the chief mate that may be necessary; or in case the master has to slip into the chart-house to look at the chart, which is often the case, he cons the ship till the master returns, as the chief mate, at such times, is generally forward tending to the anchors, and getting all ready to let go.

When the vessel is brought up, he sees the side lights are unshipped, the masthead light lowered down, and the riding lights hoisted in their proper places. If the rudder is restless, he places relieving tackles on the tiller head, unships the steam steering gear, and ships the hand gear.

The second mate takes charge of the starboard boats and all their attendant gear, and the chief mate the port boats.

In harbour he carries out all work about the bridge and after part of the vessel, and in the absence of the chief mate he assumes the perfect control of the ship; and at the present time, taking into consideration the active part he takes in carrying out the ship's duty, the second mate of a coasting steamer is a far more underpaid than an overpaid man.

This section ends with a good Example of a Coasting Log.

LOG. OF THE S.S. "H———," FROM SUNDERLAND TOWARDS ST. NAZAIRE.

| Date. | Time. | Place to Place. | Time Running. | Courses steered by | |
|---|---|---|---|---|---|
| | | | | Standard. | Lower Bridge. |
| 1890. April 21st. | 5 A.M. | Passed over Sunderland Bar. Pilot left. | H. M. | | |
| | A.M. 9 23 | Whitby High Lights abeam. | 4 23 | S.S.E. ¼ E. | S. by E. ⅜ E. |
| P.M. | 1 27 | Flamborough Head abeam. | 4 4 | S. by E. ⅛ E. | S. by E. |
| P.M. | 8 2 | Dudgeon L.V. abeam (outside). | 6 35 | do. | do. |
| P.M. | 10 45 | Hasbro L.V. abeam (through the Would). | 2 43 | do. | do. |
| April 22nd. | A.M. 0 25 | Newarp L.V. abeam (outside). | 1 40 | S.S.E. ½ E. | S.S.E. |
| A.M. | 1 20 | Cross Sand L.V. abeam (outside). | 0 55 | South. | S. ½ W. |
| A.M. | 6 45 | Shipwash L.V. abeam (outside). | 5 25 | S.S.W. ⅜ W. | S.S.W. ½ W. |
| A.M. | 9 23 | Kentish Knock L.V. abeam. | 2 38 | S. by W. ¼ W. | S. by W. |
| A.M. | 11 48 | East Goodwin L.V. abeam. | 2 25 | S.S.W. ½ W. | S.S.W. |
| P.M. | 4 13 | Dungeness Point. | 4 25 | W.S.W. | S.W. by W. |
| P.M. | 6 47 | Royal Sovereign L.V. abeam (outside). | 2 34 | W. by S. | W. by S. ½ S. |
| April 23rd. | A.M. 9 0 | Caskets abeam. | 14 13 | W. ½ S. | W. by S. ¼ S. |
| April 24th. | A.M. 0 30 | Creech Point, Ushant abeam. | 15 30 | W. by S. | W. by S. ½ S. |
| A.M. | 1 10 | Creech Point abeam on 2nd bearing. | 0 40 | Rounding | Ushant. |
| A.M. | 5 0 | Ran till 5 A.M., 33 miles S.W. by S. from Ushant. | 3 50 | S.W. by S. | S.S.W. |
| P.M. | 5 33 | Belle Isle abeam. | 16 23 | S.E. ½ S. | S.E. by S. |
| P.M. | 9 15 | Le Turc Lighthouse abeam, entrance to Loire. | 3 42 | S.E. ½ E. | S.E. by E. |

Brought up at the Lambard buoy in the St. Nazaire outer roads at 10.20 P.M.

Time from Sunderland to St. Nazaire outer roads, 3D. 17H. 20M.

Had to await next tide, as we lost our 3½ days' tide in by 2 hours.

True distance ship has run is 750 miles.
Log showed 792 ,,

42 miles in excess.

J. T., MASTER.

| Log. | Distance from Object. | REMARKS. |
|---|---|---|
| | Miles. | |
| | | DRAFT OF WATER. *Forward.* 14 ft. 9 in. — DRAFT OF WATER. *Aft.* 16 ft. 6 in. |
| 38 | 3 | |
| 73 | 2 | |
| 131 | 3 | APRIL 21ST, 1890.—Left Sunderland at the top of H.W., steady East winds and strong S.E. swell. At 6·30 A.M. set all the fore and aft sails. 8 A.M., barometer 30·20. Carried this kind of weather all day, but on drawing to the Dudgeon wind fell light; in all sails for the night, clear weather all night. |
| 156 | 1¾ | |
| 171 | ¼ | |
| 178 | ¼ | APRIL 22ND.—Towards dawn wind went into the N.W.; weather then turned gloomy, but kept clear. No canvas set. Wind very light. Vessel averages with the flood 9 knots, and against the ebb 7 knots. Off the Longsand L.V. took several azimuths on the S. by W. and S.S.W. courses. Calm and clear weather. Barometer at 8 A.M. 30·10. Longsand L.V. was swung ebb when we passed her. Noon, rounded East Goodwin L.V. 1·40 P.M., signalled at Dover Pier 32h. 40m, from Sunderland. Took azimuths before sunset from S.W. by W. to W.N.W., by the standard compass. Sunset, wind East, light; water dead smooth. At Royal Sovereign L.V. took our departure, and set log and course for the Caskets. Midnight same winds and weather. |
| 228 | 2½ | |
| 253 | ¼ | |
| 275 | ¼ | |
| 316 | 2 | |
| 340 | 1 | |
| 473 | 3½ | |
| 618 | 10 | |
| 621 | 7 | APRIL 23RD.—9 A.M., set all sails; steady E.S.E. wind and fine weather. Barometer 30·23. Carried sails all day, but took them all in at sunset. |
| 654 | — | |
| 762 | 7 | APRIL 24TH.—Sunrise, calm and clear; average speed 8¾ knots. Fine weather all the way between Ushant and Belle Isle. Barometer (noon) 29·85, falling. Calm and clear. Took several azimuths on the S.E. courses this morning. At 10 P.M., received a St. Nazaire pilot on board, just as we were letting go the anchor in St. Nazaire outer roads. |
| 792 | 3¼ | |
| | | APRIL 25TH.—7 A.M., proceeded into St. Nazaire dock, and moored in our discharging berth; all well. |
| | | DRAFT. *Aft.* 16 ft. 1 in. — *Forward.* 14 ft. 10 in. |
| | | J. T., MASTER. |

## SECTION XXXVI.

## HANDLING STEAMERS IN NARROW WATERS.

When you have a narrow channel to navigate with a screw steamer, keep as little way on the vessel as possible, only moving the engines ahead to make them steer; but as soon as the vessel answers her helm, stop the engines immediately. Most screw steamers are fitted with what are termed right-handed propellers—meaning, that when the vessel is going ahead, the propeller turns round the same way as the hands of a watch. Vessels so fitted, when turning astern, throw their heads to starboard. When rounding bends in narrow rivers, where the bends trend away on the starboard bow, it is often more advisable to put the engines half speed astern, when the vessel will more quickly fling her head to starboard (and at the same time deaden her way through the water) than she would by keeping the engines turning ahead with the helm hard a-port.

When wanting to turn a vessel round in a narrow river, endeavour to get all the way you possibly can off the vessel before you commence to put her athwart; also, if there is any tide running, try and get her in a slack if possible. Now, say all the way is off the vessel, put your helm hard over one way or the other, say you put it hard a-port—which is the best if there is no reason against it—then strike the engines full speed ahead. Before she gets much headway on her, stop her, and let her run over towards the shore as far as is prudent; then change your helm, and strike her full speed astern. After getting as far over as you dare go, change your helm over again, and strike her full speed ahead, repeating this manœuvre till the vessel turns completely round. The reason why you give the ship full speed ahead and full speed astern is, that it is found by experience that a steam vessel cants much quicker, by the action of the water from the propeller on the rudder, when the engines are going full speed, than when they are going easy.

London River Pilots invariably use this method when turning vessels round, and it is often surprising in what a narrow channel these men will turn a vessel end for end when there is a very strong tide running.

Of course if you have a wide river, and you want to turn a vessel round, keep well over to one side of the river, slow your vessel down, and get all the way off her you can, put the helm hard over, and strike her full speed ahead. When she has come about half way

round, stop her, change your helm, and strike her full speed astern. Then if you have plenty of room to keep her going astern, she will turn completely round in about three or four times her own length.

Suppose you are riding to an anchor, and want to get under weigh with a strong ebb tide running, heave up your anchor, and sheer your vessel over on the port side of the channel; then hard a-port the helm, and give her a few revolutions ahead, and stop her. The vessel now, by the action of the tide, will turn dead athwart the river. When her bow is well over on the starboard shore, change your helm, and give her full speed astern. This will hold her stern up against the tide, and she will come quickly round, much more quickly than if you had gone over on the other shore and hove her athwart with the helm hard a-starboard. But in all cases where you are going to turn a vessel round in a tideway, you must study which way the action of the propeller will hold her stern up against the tide, and act accordingly.

Of course you may be placed in such a position that it would be impossible to put the foregoing tactics into operation. If so, you must be guided by your surroundings, and act accordingly.

Now say again you are running up a river over a strong spring flood, and you want her turned round head on tide, that there is considerable traffic moving around you, and the water is very narrow.

Slow the vessel down and stop her, and let her run all the way off her. When her way is dead stopped through the water (not over the ground, as that is impossible), strike the engines full speed astern, when she will commence, when her way over the ground is deadened, to turn athwart; then let go the anchor and stop the engines. But mind, if the tide is running hot do not give her too much chain, in fact give her as little as possible, just sufficient to keep the anchor dredging on the ground—say you give her about 9 fathoms of chain to the hawse-pipe in 5 fathoms water, this will, what seamen term, "Dredge her round." (If you give her enough chain for the anchor to hold, in all human probability, if the tide is very strong, the vessel will break her chain). When the vessel begins to cant well towards the tide, strike the engines easy ahead, and pick your anchor up, or moor her as you think fit, tending the ship with the engines as necessary.

If your vessel has a left-handed propeller, and flings her head to port when her engines are going astern, the before-mentioned tactics must all be reversed; but as so very few vessels nowadays are fitted with left-handed propellers, we will not discuss their qualifications, as they are nearly obsolete, except in twin-screw vessels.

A steamer at sea out of a tideway will be turned quicker in the following way than any other:—

Go full speed ahead with your helm hard a-port until she is half round, with strong headway and a strong swing on her, then stop the engines for a few moments, still keep the helm hard a-port, and then strike her full speed astern, and when she loses her headway change the helm, and she will come very quickly round in about twice her own length. Yet this method of turning a ship at sea is not to be recommended, and should only be done in cases of emergency, as it puts a great strain on the thrust bearing, the screw, shafting, and propeller; and, as I said before, should be avoided except in emergency, then "Force push has no choice."

When wanting to place your vessel alongside of a tier or wharf with a strong tide running, mind be careful you do not get too much cant on her, or she will go heavily up against the tier or wharf, and do damage. Having steamed up slowly to abreast of the tier you want to go alongside, give your vessel a cant in, of about 2 points, with the helm. Allowing that the engines are stopped, and she has no way through the water, let her run in towards the tier with this cant of 2 points of angle till she gets about 70 or 80 feet from the tier, then hard over the helm the opposite way, and square your ship up head on tide. Say by the time she is 40 feet from the tier, if she is likely to refuse squaring up head on tide, give the engines a revolution ahead once or twice, she will then quickly square up. Then ease your helm over again towards the tier, and square her up as before, and keep doing so a little the opposite way, and sheer her in till you ease her in alongside the tier. Stand by your fenders when dropping alongside. Mind and be careful you do not give her too much angle on the tide, or she will drop in heavily, and will probably do serious damage, either to your own vessel or to the vessel you are dropping alongside of.

When you get alongside, make a hawser fast as quickly as possible, and keep her there, tending her with the engines till all is made fast.

But if the tide is running very hot, or a strong wind is blowing broadside on to the tier, it would be advisable to place your vessel half her own length ahead of the tier and drop your anchor, veering away the chain till you are abreast of the tier. Then run a hawser from your in-bow to the bow of the headmost ship in the tier, and another hawser from your in-quarter to the sternmost ship in the tier; heave away both these hawsers at the same time, and your vessel will keep head on tide, and go easily alongside of the tier.

Tend the cable as you heave in your hawsers, and slack it away handsomely; also stand by your engines. But I may remark that in heavy tideways it requires great vigilance and care to berth your

vessel alongside of a wharf or tier. If you try to do so under the circumstances mentioned above, with only a bow hawser, ten to one she goes alongside with what sailors term a "fullock;" but by running the stern hawser it avoids her getting too much angle on the tide, and she drops alongside square without doing damage.

One of the most critical jobs a seaman has to do is to berth his ship in a heavy tideway, especially if she is a long steamer; and it requires all the skill a good seaman is master of to do this satisfactorily, and is a point in which an officer can show to great advantage his power and skill in handling his ship in narrow waters.

Of course this means berthing the vessel head to tide; no sane person will try to go alongside a tier, with a heavy tide running, stern on to tide.

When about to enter narrow waters, mind and have at least one anchor ready to drop at a moment's notice, as there is no telling what may occur in the engine-room; also see that all your hawsers are ready to run away, and that your working boat is hung in the davits, and ready for action, with oars and rowlocks in their respective places; and in this boat should always be kept a small axe, to cut a hawser if it gets jammed on a post or on the ring of a buoy.

An officer should always be on the topgallant forecastle in narrow waters, so that he is on the spot if the order is given to let go the anchor—either night or day; and an officer should always be at the helm, especially so if she has steam steering gear.

When you have a tug steamer towing ahead of you, always see that he has a good scope of tow rope, for if you hang the tug with a short rope (especially so if he is a paddle tug), the backwater from his paddle wheels will run against your bows like a mill race, and prevent your vessel answering her helm. A tug alongside is of far more service to a steamer than when he is towing ahead, and is also of great utility to your vessel when you want to go astern. But very often in narrow rivers, where steam vessels require the service of tugs, it is not practicable or safe to lash the tug alongside; but if it is possible, by all means have her there, and this will help the steamer immensely in narrow water navigation.

When towing a boat in a narrow river, mind and have two ropes fast to her, one from each quarter, as this will prevent her sheering athwart and filling; also haul her well up under the stern if you are steaming fast. When you have two ropes fast to the boat, as I describe, there is no necessity for any person to be in her, as she will require no tending. Towing with one rope has drowned many a good seaman.

## THE ACTION OF RUDDER AND PROPELLER WHEN ENGINES ARE GOING ASTERN.

The action of the water thrown by the propeller against the rudder is not universally understood. Special experiments made for the purposes of this book give the following results :—

Vessel dead stopped.

Move engines full speed astern. You will observe on the starboard side two distinct streams of water running in opposite directions. The first (main) stream rushes right forward along the side. The secondary stream comes up like a whirlpool from the lower part of the arch and rushes aft, with great velocity, some 40 feet astern.

Now, as the *main* stream rushes forward it exerts no influence on the rudder or the vessel's head. Not so the *secondary* stream. For, suppose the rudder hard-a-port *(see Plate No. 124)* this stream strikes it with great power, and forces the vessel's stern to port *before she gathers stern-way.* Once she gathers stern-way the rudder will act naturally, and this stream will lose its influence.

Therefore, if you want to cant your ship's *head* quickly *to starboard,* put the helm hard-a-port, and go full speed astern ; then, directly she gathers stern-way, shift the helm hard-a-starboard.

Under similar conditions, if you want to cant her *head* to *port,* put the helm amidships and go half speed astern. The rudder amidships will not be acted on by the secondary stream. As soon as she gathers stern-way put helm hard-a-port. Her stern *ought* then to go to starboard ; but in actual practice it will often be found that, once she has begun to cant her head to starboard, the helm will exert no influence upon her however you place it, but she will turn right athwart bow to starboard unless you stop the engines, and square her up by going *ahead.* This is because the secondary stream has no influence on the rudder, and the propeller alone forces her head to starboard (or, more correctly, her *stern* to *port*).

If you want to come straight astern (in still water) place the helm amidships and go easy astern. When she gets stern-way *try* and steer her. Some vessels will obey, some will not. If you go *full* speed astern her head will at once cant to starboard.

If you want to come astern in a tideway, first give her a cant to port with head-way, then put helm amidships and come astern ; having the tide on her starboard bow she should come pretty straight astern.

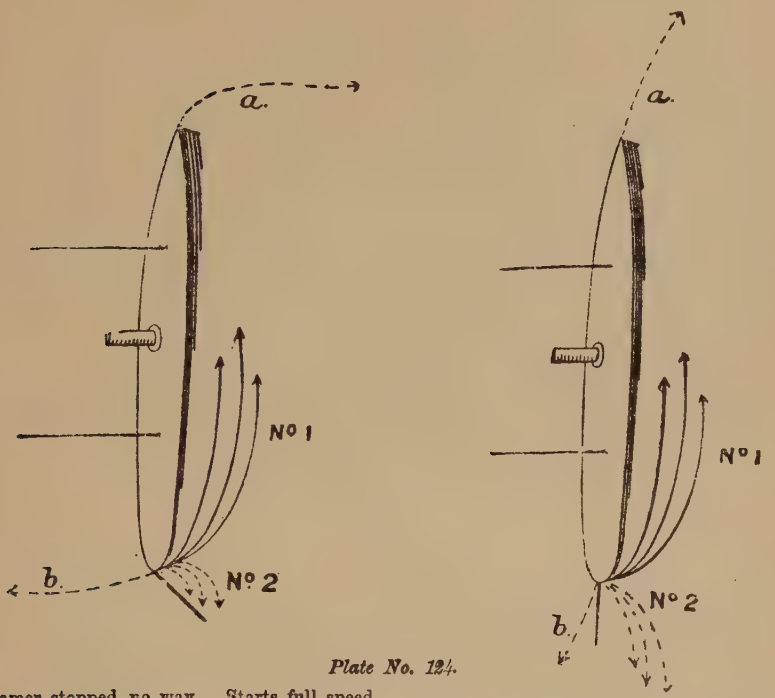


*Plate No. 124.*

Steamer stopped, no way. Starts full speed astern. Helm a-port. Her stern will come to port and her head to starboard. (No. 1 is main stream; No. 2 secondary stream acting on the rudder.)

Steamer stopped, no way. Starts full speed astern. Helm amidships. Her head will not cant so quickly as in the first case — the secondary stream not acting on the rudder.

NOTE.—As she comes astern, her head should cant in the direction of the dotted lines *a a*; her stern in the direction of *b b*.

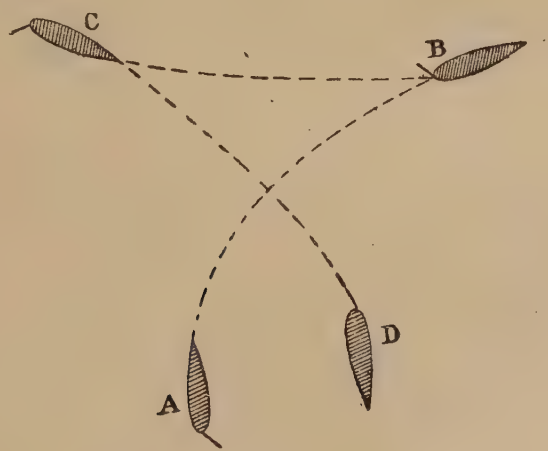


*Plate No. 125.*—A screw steamer turning end for end. *A*, goes ahead full speed, helm to port. This lands her at *B*. She then goes astern with helm a-starboard, which brings her to *C*. Then full speed ahead, helm a-port, which lands her at *D*.

NOTE.—A steamer going ahead will turn quicker to port, but to turn end for end she must act as above, for she could not cant to port under stern-way, and thus, if she started the other way about, the evolution would be a failure.

## SECTION XXXVII.

## TAKING BAR HARBOURS IN HEAVY WEATHER.

This is one of the unpleasant jobs a seaman has to encounter now and again, yet nevertheless it has to be done, so I will try to describe the method.

Before you come near the Bar *get all deck openings battened down and secure, see the engine-room skylight and stoke-hole doors are well secured,* overhaul well the wheel chains and blocks, and look well to the steering engine if you have one, and see that all these articles are well oiled. Then get two pieces of india-rubber pipe about 20 feet long, each 1 inch diameter. Put one of these pieces of pipe through each hawse hole abaft the topgallant forecastle—one on each side—and let their ends trail in the sea. On the upper end of each piece of tube lash a good-sized oil funnel; after the funnel is lashed in the pipe, lash the funnel to a stanchion, so that it will remain in a perpendicular position. Now station two men, one to each pipe, with a 3-gallon tin each of colza oil.* When the vessel enters what is termed "the selvage of the bar," that means the outermost sea that breaks on the bar, let each man gently pour the oil down the pipes; this will smooth the bar immensely, and your vessel will steer much better in the oiled water than she would otherwise.

I have often in this manner crossed Sunderland Bar in very heavy east gales with comparative safety, when the seas have been running right over the piers.

Of course if it is a very long bar you will then have to increase the quantity of oil, but I know from experience that two gallons on each side, namely, four gallons in all, crosses Sunderland Bar.

(It is always very useful to have a few spare gallons of colza oil on board, in case of shipwreck, beaching boats, boarding a wreck, &c., in heavy weather.) If the colza oil is too thick to run down the pipes freely, mix a little petroleum with it to thin it, but, I may add, *petroleum itself* is of very little service in oiling troubled waters.

If the vessel runs about much on the sea, *do not give her too much helm;* endeavour if possible to keep her under small helm, as she will take the bar much easier. Some think when the vessel yaws she will not come back again, and order the helm to be put hard over. Now this is a great mistake, for when the vessel yaws back again on the sea, she has a hard-over helm to assist her, and very often this causes

* Almost any oil of animal or vegetable origin will do, but petroleum is not of much service.

her to get that much cant that the next large wave that comes rolling after her strikes her on the quarter, and heaves her nearly athwart the sea, and she either runs into the piers or washes some one overboard. And perchance all this might have been avoided had the ship only have been guided in under *small helm.* But remember for all this there are times in crossing a dangerous bar with a heavy sea running, when it becomes a sheer necessity to jamb the helm hard over, to prevent her sheering towards the sides of the channel. I only contend keep her under small helm *if possible,* and she will run in over the sea much easier than if the rudder is kept flying about from hard a-port to hard a-starboard.

The action of the rudder when hard over causes a great amount of broken water to hang about the ship's quarters, thereby making her steer wildly on the high sea running, and endangers her turning athwart.

If it can possibly be avoided, *never* take a bar harbour on the ebb tide ; many vessels are stranded by not attending to this old and golden rule,—Always take a dangerous bar upon the *flood tide.* A regular trader tried to come in to Sunderland at half ebb during an easterly gale, with the result that two days afterwards nothing could be seen of her where she had stranded but the engines and boilers. The first warning at the head of this article should be carefully attended to before attempting to cross a bar. The writer of this article, on entering a short time back, having passed through the piers in safety, was overtaken by a heavy breaking sea, which washed the vessel fore and aft. All having been secured no accident happened, except that the firemen having neglected the warning to close their forecastle door, were washed clean out of their bunks by the sea, which *came in* over the taffrail.

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## SECTION XXXVIII.

## HANDLING STEAMERS IN HEAVY WEATHER.

Opinions amongst seamen differ very much in this respect. The probable reason being that different steamers under different circumstances act in different ways. Some advocate one position, and some another, yet general experience of steamers seems to prove that in heavy gales the best position to place a deeply-laden cargo steamer is bow to the sea, if she can be got there, and will stay there without being driven too hard.

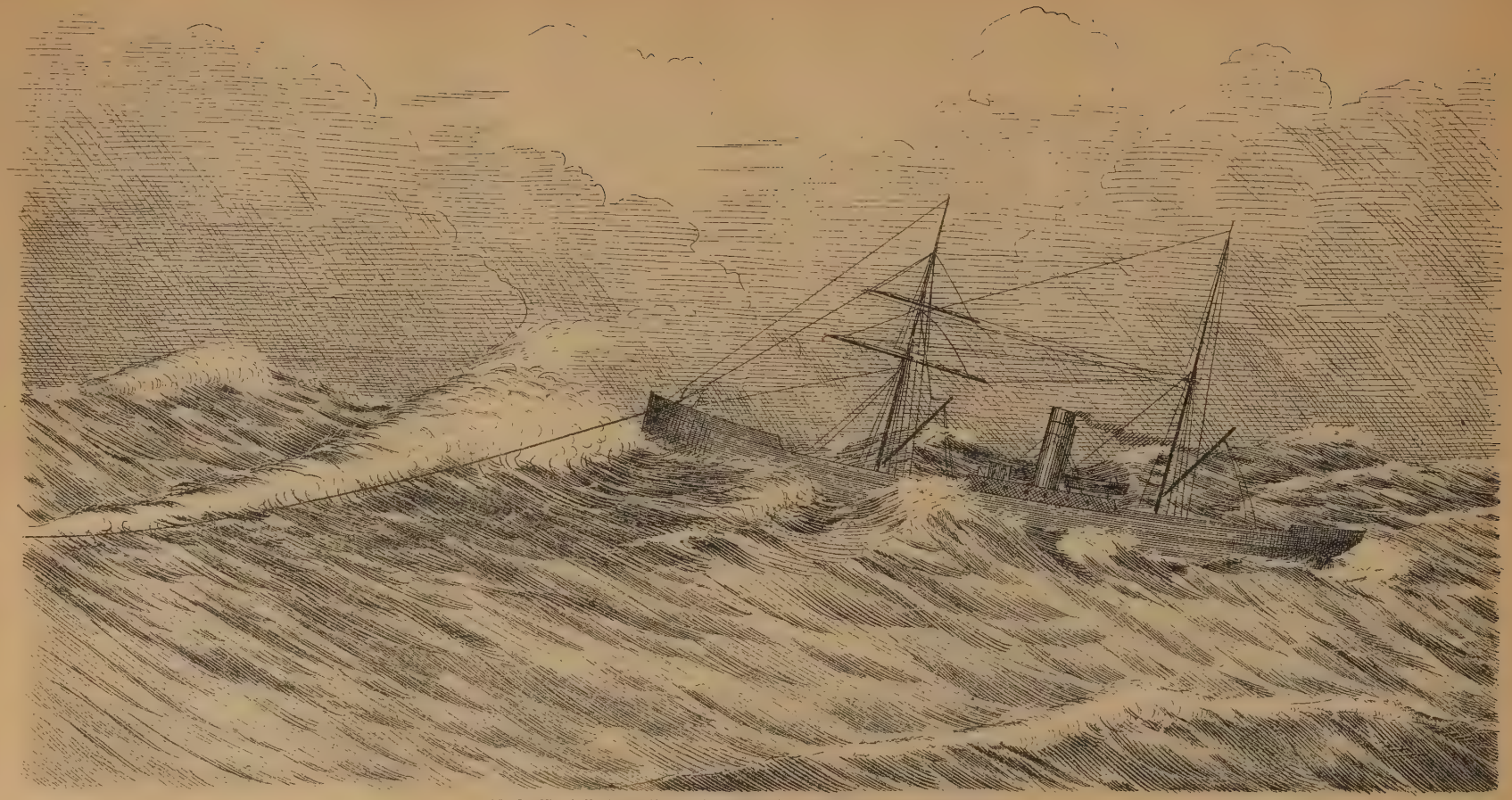
Keep the engines going as slow as possible; watch the sea, and if you see a heavy broken wave approaching the ship, stop the engines till it is past; then turn ahead again, and go on thus, nursing her carefully with the engines. Under these circumstances *the telegraph must never be left for a single moment.* If you find under such treatment she falls off a great deal, give her a few revolutions ahead, and when she comes head to sea ease her down again to dead slow. The ship's safety wholly depends on giving her as *little headway* against the sea as possible; and many vessels in this position weather out very heavy storms. Under these circumstances a good storm mainsail or mizzen should be set, with the sheet flat amidships and as taut as possible, to prevent, or rather to minimize, it shaking heavily when the vessel is head to wind.

When pulling through a heavy storm in this manner, great vigilance and care must be used by the master, and he must constantly watch the sea, with the telegraph handle in his hand.

Some seamen advocate another system of handling steamers in heavy storms, and especially so when the vessel has three masts. Their plan is to set a storm mizzen of best No. 0 canvas, taut up, bring the vessel head to wind, and stop the engines. The ship will then begin to gather stern-way, and drift slowly before the sea, the wake trending slightly on one bow or the other. Under such circumstances the seas have little or no chance of breaking on board, and if a little oil is used, the ship ought in this manner to pull safely through the heaviest storm so long as the sea keeps running fairly true. But even then the telegraph must never *be left,* and the engineer must *stand by* the engines the whole time. For every few minutes it will be necessary to start them ahead, to square her up, if she brings the sea too broad on the bow.

It is as well to remark that two-masted steamers, with their mainmast stepped well towards the centre of the vessel, will seldom keep bowing the sea in this manner, with the engines stopped, as they are apt to fall off too far, and become in a dangerous position. Therefore it depends greatly upon the *build* and rig of a steamer how she will handle best lying-to in exceptionally tempestuous weather; and this can only be come at by practical experience of each individual vessel.

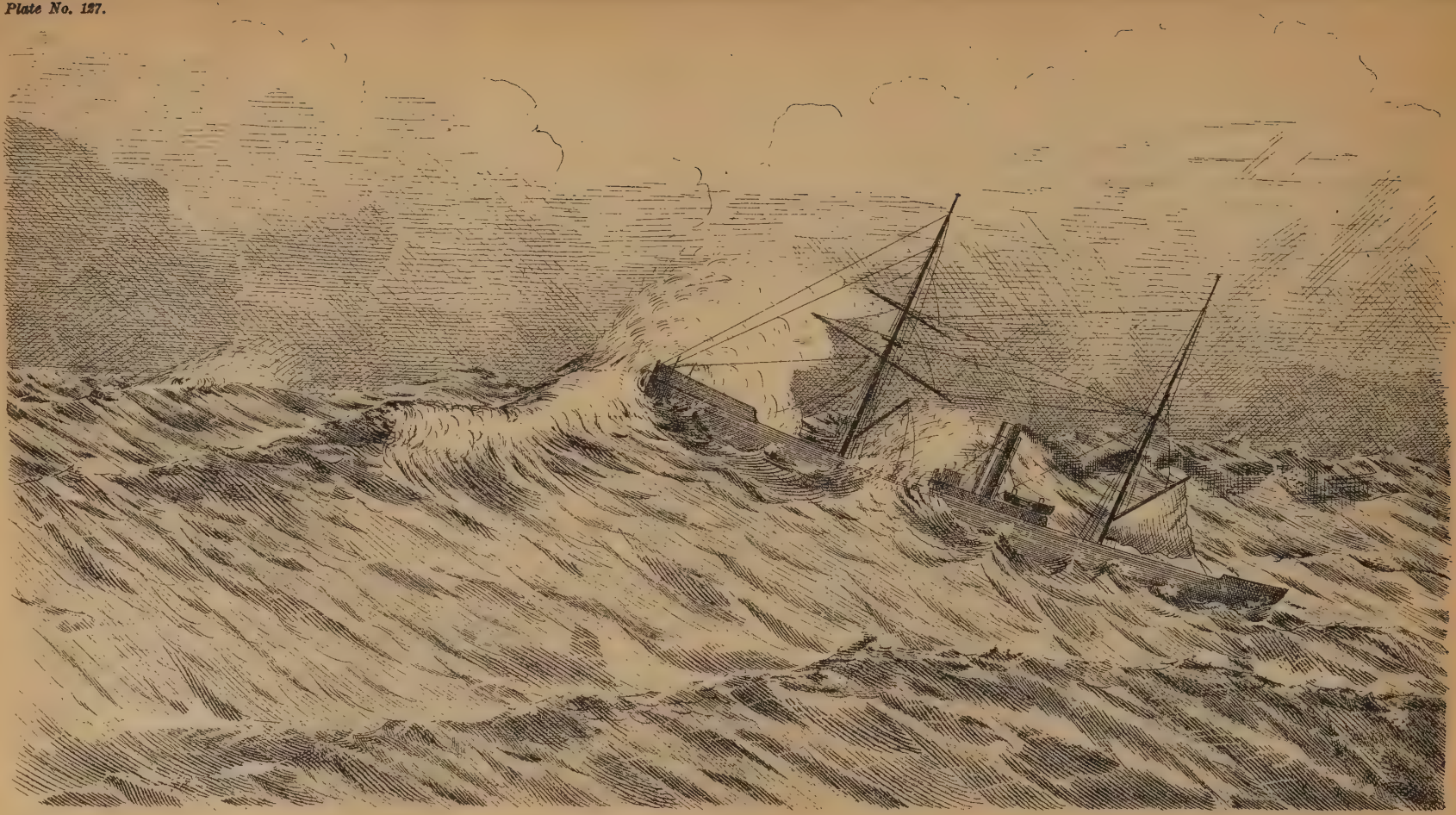
If your vessel has been running heavy before a strong gale, and it is found necessary to bring her head to sea, this will be the *critical time;* for with a cargo of coal, general, or grain, if carelessly stowed, shifting is very liable to occur; and it is a question whether it is not safer in some cases to run on, and take your chance, as the less of two evils.



STOPPED, AND RIDING TO A DROGUE, DRIFTING SLOWLY ASTERN.

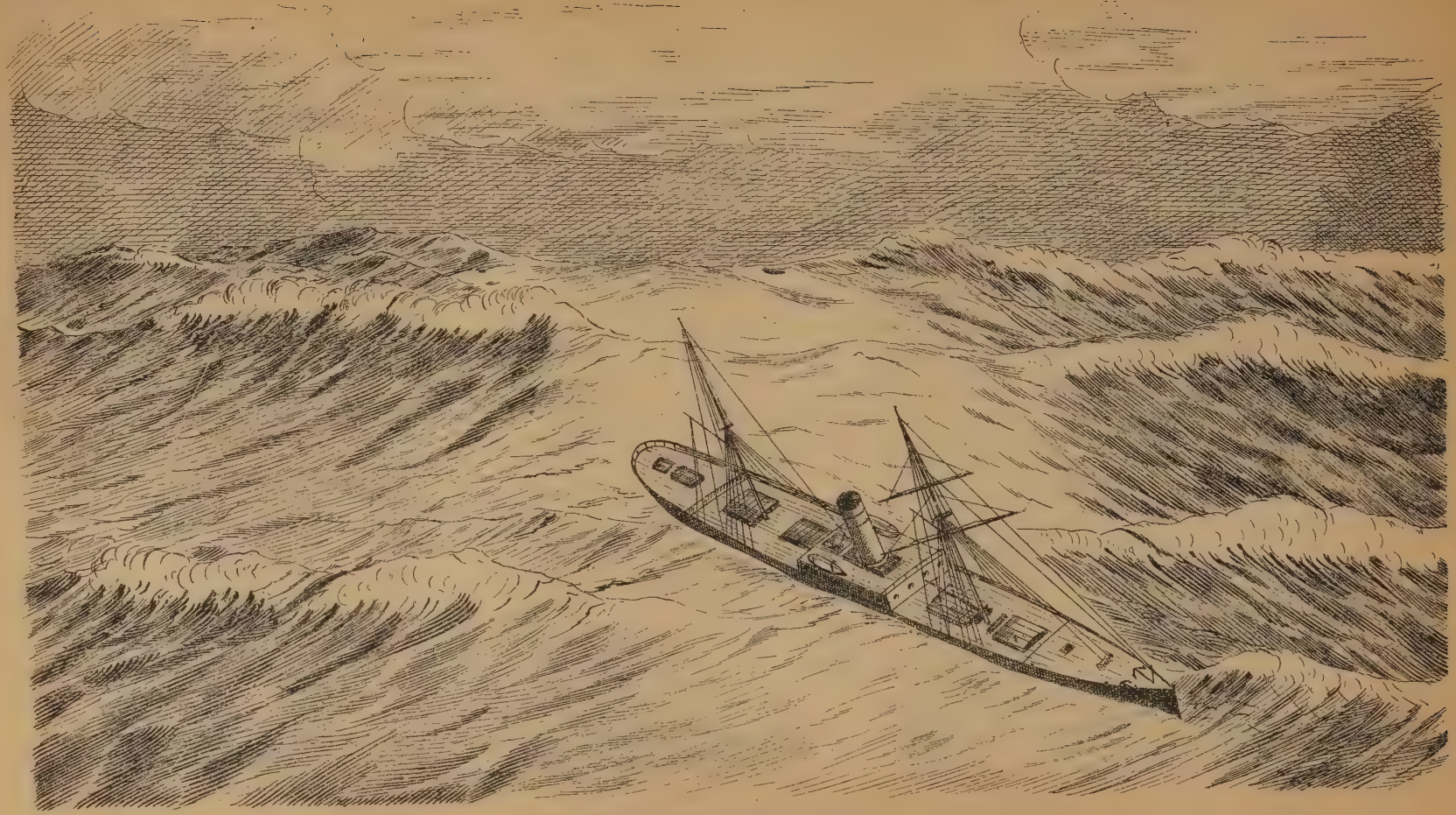
ADVANTAGES—1. Sea breaks ahead of the ship. 2. She rides dry—shipping no water. 3. Saves coal. 4. Does not strain everything to pieces. 5. Can get the benefit of an oil-bag run out ahead if it is found necessary.

*Plate No. 127.*



DRIVING AHEAD AGAINST A HEAVY GALE AND SEA.

DISADVANTAGES—Must keep driving to keep her bows on; if you ease down she will fall off, and take dangerous water on board. Oil cannot be used, and ship and engines are strained to the utmost.



LYING-TO WITH ENGINES STOPPED.

Carries a smooth oily wake to windward, which prevents the sea breaking. The vessel drifts slowly dead to leeward.

The foregoing remarks apply to ordinary *heavy* gales of wind; but supposing a *deeply laden* steamer of low freeboard be caught in one of those terrific storms that periodically occur in the winter time crossing the North Atlantic, when the force of wind is so great that no canvas will stand, it then becomes a question how to act for the best to save the vessel, for a slight mistake in manœuvring at such times may mean foundering with all hands.

It is courting almost certain disaster to round her to the wind in the ordinary way, and if she was in that position she could only be kept there by driving the engines full speed, and thus risk another source of destruction by getting headway upon the vessel during a comparative smooth, and shipping a huge Atlantic sea, which would either overwhelm the ship, start some of the transverse bulkheads about the decks, or stave in her hatches, which in the end would probably cause the ship to founder.

At the same time it may be unsafe to run her any longer, as she would ship sea after sea till the final catastrophe occurred. The question then arises, *What has to be done?* There are still three courses open that may save the ship. She must be hove-to, either head on to the sea, or with the wind and sea on the quarter; or else she may be slowed down *dead slow* and still kept before it. Let us consider these three methods.

In the first case, a sea anchor or drogue of some kind must be prepared (see page 315). Watch for a smooth, ease engines slow, and let her run her way off; then stop the engines and put the helm down; and when doing so, *heave overboard* a few *gallons of oil*,* and float the sea anchor or drogue. Keep pouring the oil on the sea down a weather pipe or scupper all the time the ship is coming to the wind.

Then if the sea anchor is of sufficient size, it will bring your vessel head to sea; but still stand by the engines to help the drogue to bring her head to sea. Once she gets safely in that position with a sea anchor ahead, your vessel is then in comparative safety, and should weather out with impunity any Atlantic storm that you may encounter.

Let us now consider the second method. Many vessels with high forecastles, and heavily rigged on the foremast, lie-to very indifferently, and keep falling off, bringing the wind and sea nearly abeam. If this be your case, and you have no time to rig a drogue, stop your engines and allow the ship to take up her own position, which will be with the wind and sea abaft the beam or on the quarter. During this evolution

* *Whilst* running, an oil bag hung over the weather side, or poured down a pipe well forward in the ship, is of great service in preventing the seas breaking aboard, and assisting her to steer better.

mind keep oiling the sea, it will help you immensely, and prevent broken seas from rolling over the weather rail; also float a couple of good oil bags out to windward of the vessel, and she must then take her chance. Some masters who advocate this position set a storm staysail forward in the ship, but in a severe N. Atlantic storm no staysail would stand.

But we cannot recommend this position of lying-to in a well-decked vessel, or in fact any vessel *that is very deeply laden.* It may be all very well in a vessel with a very high freeboard, and act well in a huge American liner, but to a deeply laden vessel it is quite a different affair. Yet for all that we are led to believe there is a better chance, even lying-to in this manner, of saving your vessel than by over-running her. She might pull through this way, where by running her too long she would eventually be overwhelmed and founder.

Great care is absolutely necessary in a well-decked vessel lying-to in the last named position, that all deck openings fore and aft are battened down and secured, especially about the well-deck forward, inside and outside the topgallant forecastle. *(See Plates No. 126, 127, and 128.)*

Some short time ago a well-decked vessel lying-to in this position with her engines broken down, was lost through a heavy sea coming on board, and gutting out the topgallant forecastle. In this forecastle was a hatch which, unfortunately, was not battened down. The water poured down this hatch and filled the fore peak, which was a large one. This brought the vessel by the head, and placed her in the trough of the sea, and made her so unseakindly that she shipped sea after sea, and eventually foundered.

And now for the third method (*see* page 126). Modern experience seems to show that the slower a vessel goes before a heavy gale and sea, the better she behaves, and many steam shipmasters now prefer to keep before it, going dead slow, to heaving-to. Many have tried this method and have found it to answer, and in such conditions, before heaving-to, it is worth while trying how the ship behaves at "dead slow." Of course great care and watchfulness is necessary.

"Never forget," remarked an old Baltic captain to the writer, "that anywhere in the North Sea you seldom have over 50 fathoms of water beneath your keel, and often only 30," and, said he—"Many and many a furious N.W. gale I have rode out in comparative safety, in the middle of the North Sea, with my two cables unshackled from the anchors, and let run out of the hawse-pipe till I had 100 fathoms on each chain out." This master for many years commanded a steamer belonging to the river Tyne, in the Baltic and Hamburg trades, and he assured me he invariably put this method in execution when it blew too hard to proceed

This is merely mentioned so as to draw the seaman's attention to the fact that, in any part of the world he may be in where shallow water prevails, and he has plenty of room to let his vessel drift, he has in his power, when so situated, the means at his disposal to ride out, or drift his vessel before the heaviest storm, when perhaps all other means have failed.

Fishermen seldom come to grief as long as the gear holds on, and this means nothing more or less than driving before a gale with their trawl down, or riding to their nets, which acts precisely the same as the cable chains mentioned above.

Tramp steamers often become unmanageable in heavy weather, and cannot be kept end on, but lie in the trough of the sea, rolling heavily and straining everything. An experienced shipmaster has tried the following method, which, he reports, answers admirably :—

Unshackle one of the cables and pay out 30 or 40 fathoms. This keeps the vessel from falling off. It of course reduces the speed, but this is better than having your ship blow athwart and become unmanageable, and it allows you to keep your course.

I have heard shipmasters on more than one occasion remark, that if a steamer's cables were let go with a large spar attached to them, or even the bare cable itself, it would ride a vessel head to sea, in the heaviest gale that ever blew in fathomless water (meaning, of course, in water of sufficient depth that a cable of 120 fathoms in length would not reach the bottom). I knew once a seaman who drifted one thousand miles in a dismasted brig belonging to the port of Sunderland, with her cables out to the bare end, and anchors attached, in the North Atlantic, till the anchors themselves brought the wreck up near Rockall.

They had overrun the little timber-laden brig coming from Quebec, and were about to try and heave her to. This man was boatswain of the brig, and he was sent down in the half-deck to cut two close reef earings—to close reef the main topsail before bringing her to. The brig was running with a double-reefed main topsail lowered down on the cap, and a reefed foresail ; he assured me the weather was terrific, and the sea running mountains high. All hands were aft, standing by to reef the sail. He had just cut the earings from a coil in the half-deck when he heard a tremendous sea strike the vessel, and at the same moment he became enveloped in water ; but, seeing the light place in the water where the hatchway was situated, he struggled up on deck with the two close reef earings still in his hand, and made himself fast to a ring bolt on the weather quarter with the reef earings. All his shipmates were gone ; all the masts and yards were floating

about alongside, and the only part of the brig above water was about ten feet of her port quarter. The huge sea had engulfed the little vessel, and had left nothing on deck above her pawl-bit. The deck load of timber all went overboard, carrying with it the rigging and lower masts; but, strange to say, the vessel came up head to sea, and remained so for many days, although her stem head was many feet below the water. The poor man used to watch for biscuits that kept floating up from below in the hole where the skylight formerly used to be. He had on a striped shirt: this he used to take off when it rained and suck it; and in this manner lived or existed this solitary man lashed on the quarter for 28 days, until some Penzance fishermen observed the wreck brought up with her anchors near Rockall, and took Carroll, which was the seaman's name, off the wreck, and saved his life, the vessel having drifted one thousand miles from where the catastrophe occurred, during the prevalence of heavy westerly gales. And he informed the writer that had the vessel not kept head to wind and sea in these gales he must have perished.

*Plate No. 129.*—Eagle Oil-tank Steamer "San Zeferino" before being sa'ved.

After being holed in the engine room, this vessel took the ground as shewn, the tanks being full of oil. She remained in this position for a month when she was successfully floated, and part of the cargo of Mexican oil was salved in perfect condition.

The cause of the brig's head lying so deep in the water was the weight of her anchors and cables hanging plumb down in the water their entire length, as no doubt the ends of her cables were well secured below to the keelson.

The old fashion in American timber droguers was to keep the cable chains stowed on deck in a well formed by the deck load, and when the little brig's deck load washed overboard, cables, anchors, windlass, &c., went along with it.

This will show what a huge Atlantic wave is capable of doing when a vessel is overrun, and at the same time prove how valuable the cables might be in saving a vessel from destruction in deep water when no other means were available.

I trust the reader will pardon me introducing this subject under the above heading, but as this case came prominently before my notice, I have thought it better to quote it as a proof of how vessels can be brought head to wind and sea in deep water by utilizing their cable chains.

The truth about this matter of heaving-to seems to be that steamers have been considered too much as *steamers*, and their power used injudiciously. A well equipped sailing ship, even deeply laden, will lie-to under a close-reefed topsail or a tarpaulin in the rigging, and weather out almost any gale, so long as she is not taken aback. Now, *she* drifts nearly dead to leeward in this position, her wake trending out to windward, and smoothing the seas before they reach her. Sailing vessels under these circumstances nowadays often use an oil bag paid out to windward to smooth the sea still more. *This is the ideal position of a laden vessel in a dangerous storm.** Now, a steamer being forced *head on*, no matter how slowly, against a gale, loses all these advantages. She will have to go at least two knots through the water to *keep* head on, so that, say she would drift two knots if engines were stopped, this would mean four knots through the water *against her*. Again, she gets no advantnge of the smooth which a wake gives, as her wake is astern; neither can she for this reason use oil, which has undoubtedly *some* value in deep water. She

* Asking a shipmaster how he got along in a certain gale.—"Oh!" he said, "First rate! I just let her lie with the whole fore trysail set, and she went along like an old shoe." Weather in which a whole fore trysail will stand, and in which a vessel will dodge along in this easy sort of way, is not the weather of which we are now treating; in such weather as that a steamer *ought* to get along all right. But the occasional terrific storms of the North Atlantic winter are quite another affair, and this article is written in the hope of advising as to the best means to be taken in such weather, where nothing but an exceptionally well set close-reefed sail of new canvas has any chance of standing. All experienced Atlantic men know the kind of gale referred to.

strains her engines very much, for they *must* be kept going nearly full speed, with heavy racing as a result, and altogether is not in an enviable position. A steamer *hove-to* (and by *hove-to* I mean drifting to leeward), is decidedly at an advantage in every way, and the only question to be considered is whether she will lie best, like a sailing ship, with the wake trending abeam or a little abaft it, or *head on*, or whether she can be kept stern on and going ahead, dead slow. If head on, she either wants an after storm-sail of some kind or else a sea anchor, the engines only being used when necessary to square her up. If beam on, she must have a decent freeboard, and a *deep laden* well-decker should not attempt it.

## SECTION XXXIX.

## HOW TO RIG A DROGUE OR SEA ANCHOR.

One of these useful but hitherto neglected articles should be on board every cargo steamer afloat.

They can be purchased all ready made, and several are patented. A very good description of sea anchor for a large vessel was exhibited some time ago at the Tynemouth Exhibition, but in case any one wants to construct one himself the *modus operandi* is thus explained.

First of all procure two spars about the size of your fore or main boom, say about 10 inches in diameter—either round or square spars will do. These spars should be the length of half the beam of your vessel; thus, if your vessel is 36 feet beam, these spars should be 18 feet long each. Now place one spar over the other in the form of a cross *(see Plate No. 130)*, and securely lash them together by a stout cross lashing, to make them as rigid as possible. Next take a piece of $\frac{5}{8}$ chain, and make one end of it fast to one arm of the cross formed by the spars, haul it taut, and clove-hitch it to the next arm, and so on till the chain goes round the cross, and well secure the end.

Next take a good piece of stout chain and form a double bridle on each spar, fit in the same manner as the bridle of a common kite, for a sea anchor is nothing more than a large water kite.

NOTE.—The ends of this chain bridle will have to be passed through the eyelet holes in the canvas mentioned below, so only make the ends temporarily fast, just to fit it.

Then take a strong new untarred tarpaulin, double it, and lash it securely on one face of the spars to the chain you first made fast to each leg of the cross, cut four small holes in it in the wake of each

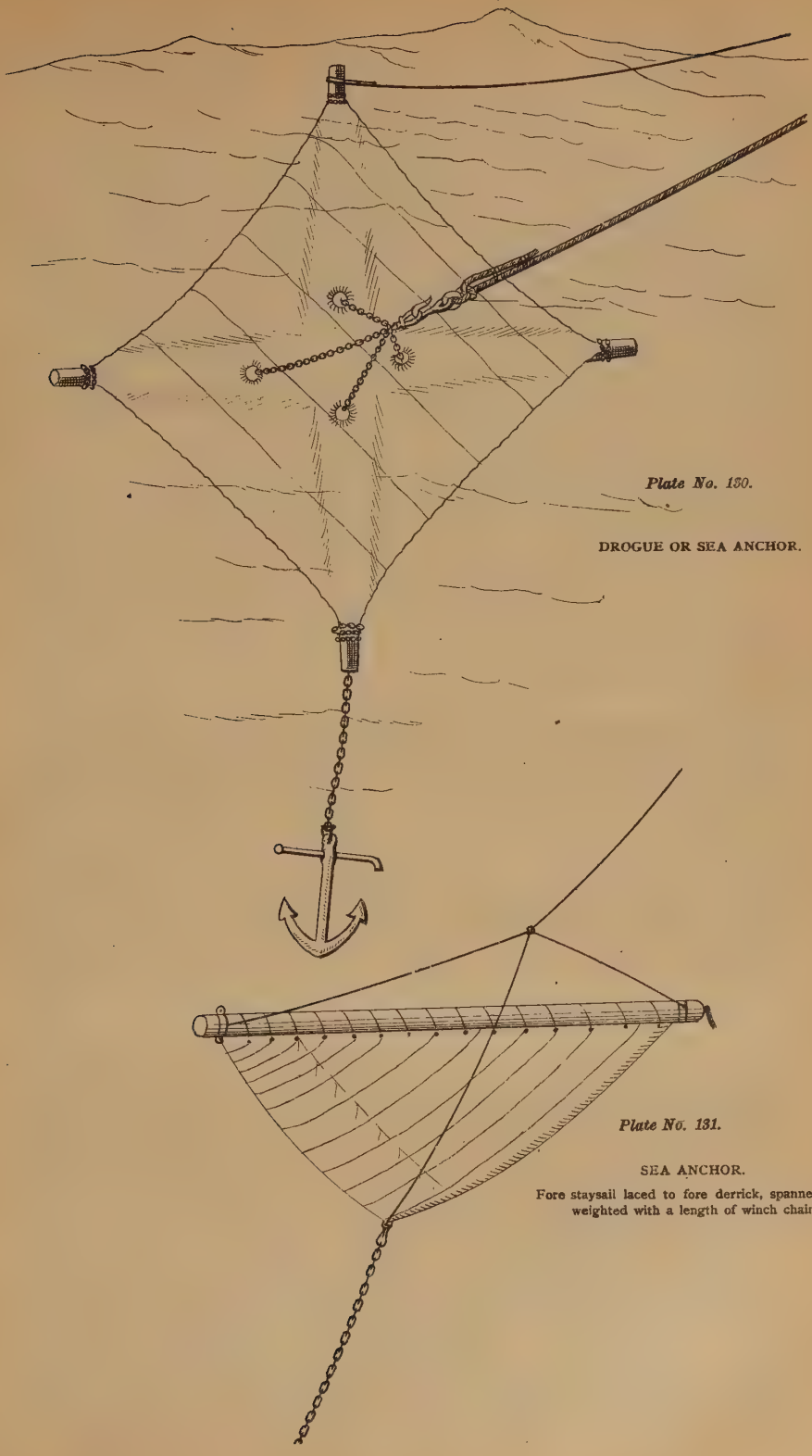


*Plate No. 130.*

DROGUE OR SEA ANCHOR.

*Plate No. 131.*

SEA ANCHOR.

Fore staysail laced to fore derrick, spanned and weighted with a length of winch chain

part of the bridle, and securely hitch the bridle for good round each spar, after passing it through the holes.

Of course if you have plenty of time at your disposal, make a properly fitted double canvas covering the proper size of the cross, work eyelet holes round its edges, and four large eyelet holes in it where the bridle passes through it, and mind when sewing the canvas cover, let the cloths be sewn so that in one part of the canvas the cloths run at right angles to the other, to give the sail greater strength to withstand the water pressure it will always be subject to in heavy gales. Now, if the canvas is stretched taut on the cross, and the bridles well fit, so that they bear an equal strain on each part of the spars, you have a good serviceable sea anchor or drogue that will ride your vessel in a heavy gale, and allow your ship to drift with her engines stopped, head to sea, in comparative safety.

When wanting to stream the sea anchor act thus. As it will be of considerable weight, you will require a good tackle on the fore yard, just outside the plumb of the rail to get it over the side. If your vessel is fore-and-aft rigged, the tackle can be placed well up on the fore topmast backstay.

All being now ready, pass a good long hawser, of sufficient strength to ride your vessel, out of the bow chock on the forecastle, and bring it aft outside the rail clear of all gear, and make it securely fast to the middle of the bridle of the sea anchor in the same manner as you would attach a kite string to a common kite. At the same time make a good 3-inch line fast to the arm of the kite you intend to be the upper arm when it is in the water. You will require this line when taking the sea anchor on board. Place now on the upper arm a rope strop, hook on your tackle, and overend the drogue, pulling it high enough to clear the ship's rail. Now lash on to the lower arm a kedge anchor, or better still, an anchor stock; this is to keep the drogue well immersed in the water in an upright position. Lower away the tackle and shove the drogue over the side, and when the rope strop, where the tackle is hooked, comes on a level with the rail, cut the strop and veer away the hawser.

The vessel should have been brought to the wind, or as near as she would come, and the engines stopped before streaming the sea anchor. Mind, do not hang the sea anchor with a small scope of rope—veer away the hawser you have employed for the purpose to its bare end, the more rope you have out the better will the drogue do its work, and your ship will tend the sea more kindly.

When you want to take on board the sea anchor, take the line you

made fast to its upper arm to the winch; heave on it, and the drogue will assume a horizontal position in the water, and be hove alongside with the greatest of ease. Take in the slack of the riding hawser at the same time, then hook on your tackle and heave it on board.

Two spars, as described above, might always be kept in readiness with a large bolt with a nut fitted through their centres, and shut together like a pair of scissors. These spars could be lashed in some snug place alongside of the bulwarks, and would take up little or no room. Were such the case, a sea anchor might easily be rigged in half an hour.

In case of sudden emergency, such as engines breaking down, or steering gear giving way in the height of a heavy gale, a good bear-a-hand drogue may be rigged in a very short time, thus:—Unship the fore-boom, and at the same time unbend the fore staysail, lash the luff rope of the staysail along the boom *(see Plate No. 131)*, and weight the lower part of the sail with a few fathoms of winch chain shackled on the clew cringle. Then form a long span with three legs, each leg of the span ought to be the length of the boom (this span may be formed with either rope or chain, the latter is to be preferred).

When securing the span to the drogue, take two ends of the span and hitch one on each end of the boom, the third and remaining end is shackled on to the clew cringle of the staysail.

At the apex of the span shackle on your towline, or a good stout hawser, then drop the boom carefully over the side, and veer away the hawser as required.

You can ride by this drogue whilst repairing a temporary break-down, or till you get a properly constructed sea anchor rigged.

If no time even for this, and the ship is in danger, knock the pin out of one of your cable shackles, and pay out 60 fathoms of bare cable—this will probably bring her head on.*

But all this trouble may be avoided by having on board, ready for immediate use, a properly fitted sea anchor, ready in its place with all its attendant gear. It would only cost a few pounds, and in a new vessel's outfit would really mean nothing, when its great utility is taken into equitable consideration.

Many a fine sailing ship and steamer would be afloat to-day that now lies low in old Davy Jones's locker had they had on board (and used) that hitherto despised and neglected safeguard—a good sea anchor.

* With a modern tramp in deep water, and a heavy sea, it is doubtful whether anything less than a water sail sea anchor, such as described above, will bring her head on; such makeshift attempts as paying out a hawser are no use whatever.

## SECTION XL.

# TOWAGE.

We are not about to open out on the different systems of towage in ordinary, but intend offering up a few remarks on sea towage in cases of breakdown of steamers, as it may be of service to the young officer in a case of emergency.

It is not generally known how useful a common rocket may be in establishing communication between two vessels in a heavy sea.

A common 1-lb. rocket will carry athwart the wind a small fishing line over 200 feet.

In cases where a steamer has run close to a disabled ship to take her in tow, rockets have been found very serviceable. When firing the rocket, have the fishing line flaked down on the deck, with one end fast on deck, the other hitched to the end of the rocket staff, a few inches from its lower end; now give the rocket a good elevation and fire it, and if it is a good ordinary ship's rocket it will carry the line over 200 feet.

On to this line bend on a ball of amberline, then a small rope, and lastly the hawser, as occasion may require.

Of course if it is fine weather when you pick up a disabled vessel, out boat at once and effect communication, but in bad weather nothing is so valuable to effect communication without risk to life as a common ship's rocket.

The writer was once broken down in the North Sea, during the prevalence of a heavy N.E. gale, and although the towing hawsers carried away six times, communication was easily effected each time the hawsers parted by the use of the ship's rockets.

Before the wind a rocket will carry a line considerably over 200 feet, and might often be the means of saving life in case of shipwreck where no rocket apparatus on shore was obtainable.

Say you observe a steamer with signals flying, "Will you take me in tow?" First of all, if the weather is bad and a heavy sea running, get ready the rocket and line. When all is ready steam your vessel close to the bow of the disabled ship, with very little way on your vessel, and fire the rocket over her amidships. Communication is now established. A large line bent on the fishing line will pull the end of a coil of ratline on board, and then a lanyard rope. If you or the other vessel have large and powerful coir hawsers, then get these fast and tow away; but if you have only an ordinary europe hawser each,

besides the steel ropes that every steamer is well supplied with nowadays, it is useless playing with them; for if there is any sea running, and the tow is a heavy laden ship, the ropes will break as soon as ever you commence to tow, so our advice is, do not bother with them, but act thus:—After you have got a good lanyard rope between the two vessels, get your ship into a position, head to sea—ahead of the tow—and send on board of the tow, by the lanyard rope, a strong steel hawser, then tell the tow to bend on to your steel hawser his bower cable, then heave away upon the hawser, and get his cable on board, take it round your after bits, then back it round the 'midship bits and shackle its end on to the mainmast, or run your own cable aft from the windlass along the decks, and shackle the two cable ends together, either mode is a strong one; then tell the tow on NO ACCOUNT to hang you with a short cable, but to give you at least 90 or 100 fathoms of cable. Once you have this well fast you will tow the heaviest ship with impunity in a very strong sea-way—in fact the cable will never become taut out of the water, for long before 80 fathoms of cable chain can become taut out of the water the tow will run ahead and slack it down.

The writer has known heavy steamers that were broken down towed by the cable chains when the largest ropes a large English ironclad had on board had all parted. Many seamen think a cable is a horrid thing to tow with, reasoning to themselves, "chain has no give in it," but a long cable always forms a *catenery*, and this would never be less in a tow than from 10 to 15 feet, consequently you may say the cable has as much give in it as is formed by the catenery; but this is actually not the case, as the tow will always range ahead (provided 90 fathoms is out) before a pure catenery is formed. Thus a cable is the very strongest thing you can tow with, and if ordinary care is used, there is little or no fear of it getting foul of your propeller. *

Even if you do tow with coir hawsers they should be shackled on the tow's cables, and 15 fathoms of cable paid out on board the tow.

When towing with the cables, mind and do not hang the vessel short with 40 or 50 fathoms; if you do the chain will become taut before the ship forges ahead to it, with the concomitant result—break it must. Many a tow that has been abandoned would not have been so had the cables been used as above directed. If necessary, you will also have to stand by with the engines to ease the jerks as much as possible.

In towing a disabled vessel remember it is easier to tow her athwart or before the sea a hundred miles than it is to tow her 20 miles head to wind and sea.

*In any case, with a heavy tow, be sure to use strong enough gear; and it is a good thing to attach a weight to the centre of the tow line to prevent sudden tautening and possible snapping.

Whilst towing a disabled ship over a bar, or where the sea is very wicked, put over your stern a couple of oil bags; it will ease the sea on the tow immensely.

If you fall in with a disabled ship with no rudder, but whose engines are all right, let the disabled ship tow you, and you steer her by steering the course yourself; but this is a difficult feat to accomplish successfully, and fine weather must prevail for you to do so. If you think the weather is too bad to do this successfully, then take the disabled ship in tow, and let the latter pay over his stern a long hawser with a stop water on it on one quarter, with a powerful tackle fast to the hawser led on the opposite quarter, and veer and haul upon this tackle as necessary. This will keep her steady whilst towing.

If ever you are compelled to tow with steel hawsers, 30 fathoms of rope hawser had better be shackled on to the ends, or they will be sure to carry away if there is any sea running. If you have no rope stout enough for the purpose, then let the tow shackle on to the ends of your steel hawsers 15 fathoms of cable chain; this will cause the wire hawsers to sagg, and prevent them carrying away if the sea is not too heavy. But it must be remembered that wire ropes are of no use in a sea-way to themselves to tow with, for they will not bear a jerking strain.

All steamers should have a large and powerful coir hawser for a towline, and it should never be used but for that especial service.

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## SECTION XLI.

## COLLISION.

As this important matter forms one of the chief factors in the loss of life at sea, besides sending princely fortunes annually to swell up the contents of old Davy Jones's locker, we feel we cannot be too careful in guarding the young mariner, and offering him some advice on this great peril of the sea; yet the different conditions under which collisions occur render it very difficult to decide at what point to commence the necessary remarks to that effect.

Firstly, then, we advise, never run vessel's lights fine at night time. Thus, say you observe a steamer's masthead and green light *very fine* on your starboard bow, say half a point: if the channel will permit of you doing so, starboard half a point or more, this brings the other vessel one point or more on your bow, and gives both steamers a better chance to clear one another, if any alteration of their helms have to be made

afterwards, through perhaps a sailing vessel standing athwart between the two approaching steamers. Act in the same manner with port and masthead light. If first seen fine on the port bow, port a little and bring the other vessel's lights a point more, if necessary, on your port bow. Such manœuvring is termed *not running lights fine.*

Of course, in very narrow waters, like canal navigation, you are compelled to run lights fine; but when such is the case, to lessen the risk as much as possible, take all the way you possibly can off your vessel before closing with the other ship.

The most dangerous cases of running lights fine the writer knows of at the present day, is navigating the large canals in Holland, where approaching vessels keep each other's lights dead ahead till they approach to within four or five hundred feet; then each vessel ports her helm and they pass within a few feet of each other. Serious damage often occurs in this canal navigation, and it might easily be avoided by sidings, one vessel to lie by till the other passed, as is done in the Suez Canal; but such, I am sorry to say, is not the case. Why canal navigation has been cited is, that it exemplifies to the greatest extent the great danger of running lights fine.

Many old river navigators when reading this over may remark, that if you keep away for every light you make ahead in narrow waters you will either run your ship hard and fast ashore, or lose your tide. My answer to this is, the writer, for nearly twenty years, has navigated the Thames, Elbe, Seine, and Gironde, large rivers on which there is great traffic, yet he never remembers once losing his tide, or running his ship ashore, through not running other vessels *lights fine.**

When two steamers are passing on opposite courses, so that if each held on her course they would pass clear of each other—

"Green to green—"

For one of them to port his helm, and cross the opposite vessel's bow, thus showing his red to the other's green, is a most *lubberly trick*, unworthy of anyone calling himself a seaman to do. Never condescend to such a vile practice, it is directly acting against the Rule of the Road; at the same time always be on the look-out for this in an approaching steamer, as it is a thing often done.

The proper and safe way in such cases is that mentioned at the beginning of this article, namely, *not to run lights fine.*

As regards starboarding the helm for a red light, nothing need be said, as it would be nothing short of madness to do so.

* Of course, the general rule in river navigation is to keep to the starboard side of the channel; the above remarks are not intended to contradict that rule in any way.

Say two crossing vessels are approaching one another very close—not having seen each other through fog, snow, &c., till the last moment. If the vessel is crossing your bows to starboard, stop the engines instanter, but mind (if you have a right-handed propeller), do not put the engines full speed astern. If you do, you will take away her only chance to slip clear, and you will have made a collision inevitable.

But how different if she is crossing your bows to port. Then stop your engines and ring her full speed astern; your vessel's bow will then fly to starboard, and it will assist the other ship immensely to slip clear. *(See Plate No. 132).*

I again caution the young officer to never forget that, at close quarters, by going full speed astern to a ship crossing his bows to starboard, he is then trying his very best to get his vessel into collision.

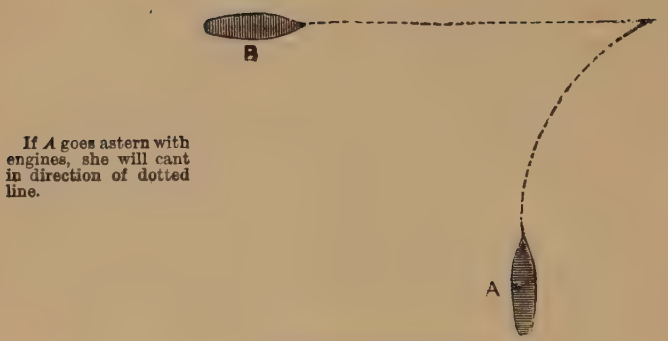
In crossing ships at night time, on right-angled courses, if the other vessel's lights bear four points from your bow, you may at once conclude the two ships will come close together, and it all depends upon their relative speed which ship will head the other; if the bearing of the light remains the same, the two vessels will come within a dangerous nearness to each other.

Very often crossing vessels, with their green light opposed to your red, will keep hanging on to the last minute, no doubt presuming they can cross you.

This proceeding is very dangerous, and is totally opposed to the Rule of the Road; you feel and know when thus situated that you are justified by law in doing nothing, but hold on steadfastly on your course; and yet you wish to slow down and give the other vessel a blast on your whistle. But you must not do so. *You must keep your speed. You must also keep your course*, until by the action of the other vessel alone collision cannot be averted. Then, and then only, may *you* take action.

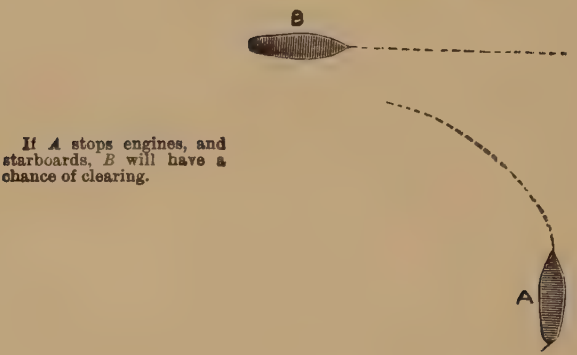
Thus, though a reckless lubber in the other ship does wrong, it does not absolve you from seeing that a collision does not occur. Very fast steamers will often run with their green light exposed to your red, trusting to their great speed to clear your vessel, but it is a most *dangerous proceeding*, and ought to be punishable by law even if an accident does not take place, but the great difficulty would be to bring these offenders to justice, and well they know it, as at night time it is impossible to particularize a vessel. Such hap-hazard work is commonly done at the present day, especially by the swift cross-channel paddle boats, and frequently leads to disaster.

Be careful always to apprize a following ship of your whereabouts, by flashing or shewing a stern light.



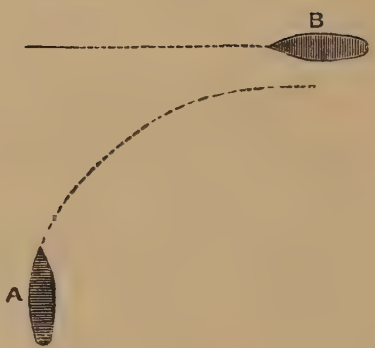

If *A* goes astern with engines, she will cant in direction of dotted line.

*Plate No. 132.*—Case 1.




If *A* stops engines, and starboards, *B* will have a chance of clearing.

Case 2.




If *A* goes astern, she will cant by dotted line, and will help *B* to clear.

Case 3.

If you are in great doubt of two *meeting* vessels clearing each other, do not expose the broadside of your vessel by starboarding or porting the helm more than is actually necessary, for remember the more you expose your broadside, the less chance there is at the last moment of the other vessel slipping clear along your side. London river pilots

work a good deal on this rule, viz., they never give a vessel more cant on her helm than will *just point clear* of the approaching ship, as they consider the smaller cant each vessel has, the greater probability there is that they will slip clear of each other as they pass. This of course means when meeting end on, or nearly end on, at *close quarters; remember that when the helm is put hard over, the stern moves much faster than the head of the vessel.*

In any case of collision, before the actual impact of the two vessels occurs, the *first order* should always be (so as to give those below a chance for their lives), "*Call all hands on deck!*" then follows, "Clear away the boats, stand by lifebuoys and lines, and light the deck lights." If you have struck the other vessel in a strong sea-way, back your ship astern as quickly as possible, and out lifeboats at once; place a lifebuoy and line in each boat, and also a deck lamp. It is very necessary to have a light in each boat, especially so if the night is dark and bad weather prevails, as it enables the boats to be picked up quickly after the accident.

In *smooth water*, if you have struck another vessel anywhere in her broadside, and you are led to believe by the force of the blow that the other vessel will founder, keep your engines going easily ahead, so as to keep your vessel's stem in the breach, and order one of your ladders to be placed over your bows on board the sinking ship; this will enable her crew to jump on board your vessel in a couple of minutes. Through the want of this precaution being taken in collisions, many lives have been sacrificed; you must remember, considering you have struck the other vessel amidships, that in all probability your topgallant forecastle is high above the other vessel's rail, therefore it is a very difficult matter for the sinking ship's crew to get on board your vessel without the assistance of a ladder. As soon as the crew are all on board, back your vessel out clear of her, and examine the collision bulkhead; if the fore-peak is full of water, which it probably will be if the collision has been a heavy one, go down the No. 1 hold and shore up the collision bulkhead (of course if your ship is fully laden that is impossible); and afterwards remember and drive your vessel as slow as possible till you get her into a place of safety (for the faster you drive the vessel the greater will the strain be on the collision bulkhead), and have all your boats ready to lower at a moment's notice, in case the bulkhead gives way.

Great care is absolutely necessary when keeping your engines ahead into a sinking vessel, and mind this can only be done *in smooth water.* If you were to do so with any sea on, the chances are you would rip

open the whole bows of your ship, which would start the collision bulkhead, when foundering would be the result.

In many cases of collision the vessel rebounds and strikes a second blow, caused by the great impetus or momentum of a heavy striking body. When such is the case, the collision is a very heavy one, and generally ends by the sinking of the stricken vessel. In such a case, in all probability the vessel that has struck the other with her stem is in no immediate danger of sinking, so it is her duty to stand by and assist all in her power the other vessel.

If it so happens that the stricken vessel can be kept afloat, it is the duty of the other vessel to tow or assist her into a place of safety.

In all cases of collision, one vessel must stand by the other as long as necessary, and it is punishable by law if one vessel forsakes the other, besides being cowardly in the extreme.

It is very difficult indeed to give any directions how to act to avert collision during foggy weather; our advice is, go as slow as you possibly can if the fog is very dense, as it gives you more time to clear an approaching vessel. All you may hear said about keeping good way on your vessel, as it makes her answer her helm quicker, treat with the contempt it deserves, for, depend upon it, such is a fallacy, and a most hazardous and dangerous expedient to resort to.

In a dense fog, if it is at all possible, by all means *anchor your vessel.* You have then decreased the risk of collision just 50 per cent., and do not be frightened to let go the anchor in an exposed locality, as it seldom comes on to blow hard as long as a fog lasts; it is almost sure to clear up before it blows hard. But, at the same time, do not anchor right in the fairway, as a bell is a poor thing to hear in a fog, and anchored thus, you are a danger to those who are still under weigh.

But say you are compelled by the force of circumstances to keep on, and the weather is very thick, and you hear a whistle bearing right ahead (we will assume you are going dead slow), stop the engines, and run as much way as possible off the ship, but do not keep them stopped till she loses steerage way; if she is likely to do that, keep touching the engines ahead, and stopping them. If the other vessel appears to be drawing to close quarters, keep sounding your whistle at shorter intervals than usual; say the other steamer's whistle keeps bearing dead ahead, you may conclude the two ships are steering on direct *opposite courses.* If so, it is very evident *something must be done,* for if you wait *till you can see each other,* the vessels may be so close then, that before any manœuvre can be put into execution the vessels will collide.

Under such circumstances, the *general custom* is to use the warning signals, *before* seeing the other vessel; but remember if you do use them before sighting the approaching vessel, and the other steamer *does not* use them, and you get into collision, you will be held in fault, for the law distinctly specifies these signals have only to be used by vessels *in sight of one another*, yet they are commonly used before that takes place, which saves dozens of collisions; but as it is against maritime law to use them, great discretion is absolutely necessary when applying them.

These signals are—

1 quick blast—'I am porting my helm,' or 'altering my course to starboard.'

2 quick blasts—'I am starboarding my helm,' or 'altering my course to port.'

3 quick blasts—'My engines are going full speed astern.'

As we remarked above, the general custom on our coasts, and in river navigation amongst heavy traffic during fog, is, when a vessel's whistle is heard ahead and closing with you, if the fog is very dense, to give him a signal, either one or two blows, which at once tells him the side on which you intend to pass, and the way you have put your helm. If the other vessel answers your signal satisfactorily, all is right; if not, and the ships were at close quarters, the best policy would undoubtedly be to go full speed astern, and give him three blows of your whistle. But endeavour if possible not to throw your ship dead athwart your course, as it gives the approaching steamer the whole length of your broadside for a target.

There is yet another dodge to slip a vessel approaching from ahead, but this also must be applied with the greatest caution, as it is unrecognised in maritime law, yet many seamen often put it in force to save a collision. It is termed the 8-point evolution.* Thus, say you hear a steamer's whistle ahead, and are doubtful how she is heading, hard over with your helm either to port or starboard, whichever way you have determined to cant the vessel (mind this manœuvre must be executed before the vessels come to close quarters), and steady the helm when she heads 8 points from the course you were previously steering; then touch her ahead half speed for a few minutes and stop the engines. If the other vessel's whistle now draws astern, you may conclude she is steering in an opposite course to your own vessel, so

* The legality of this proceeding has been questioned, but after due consideration we allow it to appear. The rule says (Art. 16) that a vessel in such position is to "*navigate with caution until danger of collision is over.*"

## THE 8-POINT EVOLUTION DURING FOG.

*A*, steering North, hears whistle ahead. Puts helm hard-a-port, and keeps her East. When nearing the * he finds whistle getting closer; concludes it is a vessel steering to S.Ed. Ports helm again, and comes round to West. Soon loses other whistle, all clear.

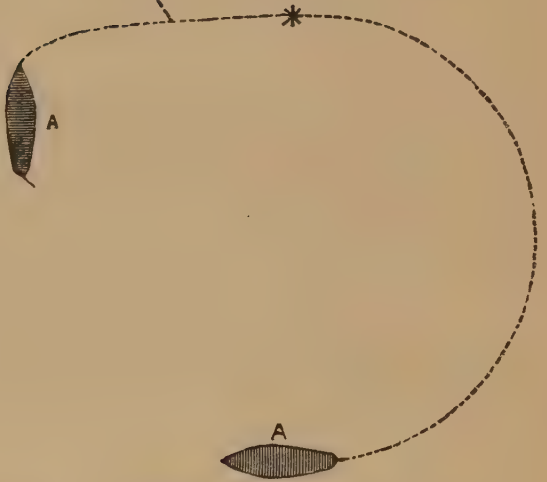
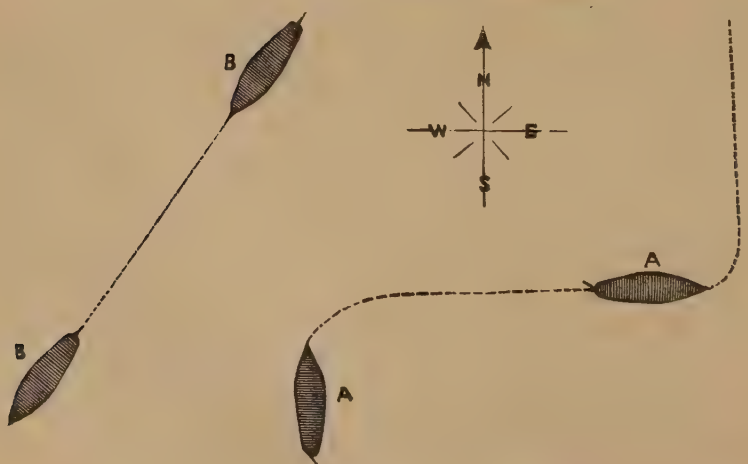



*Plate No. 133.*—Position 1.




*A*, steering North, hears whistle ahead; ports out to East. *B*'s whistle now heard astern. All clear, keep her on her course.

Position 2.

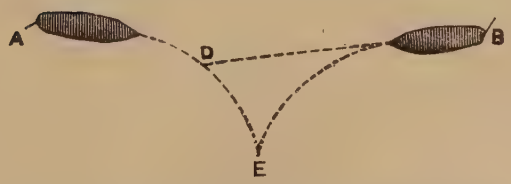
will pass all clear. If, on the other hand, she turns out to be a crossing vessel, which can easily be determined by her whistle getting nearer to you, after you have altered the direction of the ship's head 8 points, you may conclude you have canted your vessel the wrong way; yet no harm is done. Again put your helm hard over as before, strike the engines easy ahead, and let her come round 16 points more, making 24 points in all, from the direction of her head before altering the course *(see Plate No. 133)*, and steady the helm. The other vessel's whistle will now be soon lost, as you are proceeding in opposite directions—stern to stern. Mind this 8-point business can only be done in open water, where there is little traffic, and must not be done if there are any vessels coming up astern of you; yet in open ocean navigation it is a dodge not to be despised.

In very still weather during fog a good powerful voice can be heard at sea half a mile. When such is the case, and two steamers are at close quarters, hail the other vessel, and ask him how his head is; the answer will remove all doubt, and you can act accordingly.

With two steamers suddenly sighting each other, end on, in a fog, if both vessels go full speed astern, and both have *right handed* propellers, on port helm they stand a good chance of clearing each other. But, unfortunately, there are still *left handed* propellers in existence; and suppose one of these ships has such a propeller, in that case if both went astern, the right handed propeller would cant the ship to starboard, and the left handed propeller would cant the vessel to port, and the result would probably be a collision. *(See Plate No. 134.)*

*Plate No. 134.*—Case 1.

Two steamers meeting nearly end on. One, *A*, has a right-handed propeller, *B* a left-handed.




Case 2.

The same vessels sighting each other at close quarters, both go hard-a-port, and full speed astern. *A* probably answers her helm, and cants to starboard, the propeller assisting; *B's* propeller working against her helm, she may either come straight ahead, or probably cant against her helm. Consequence, collision at points *D* or *E*.

Again, some steamers with propellers, the blades of which rake aft, are very slack in stays when wanted to go astern. Remember, also, in tidal waters, that though both vessels may be only steaming three or four knots per hour, one vessel has the tide with her, which accelerates her speed considerably more than it retards the speed of the other vessel over the ground.

The writer has often heard it remarked—'Never alter your helm in a fog for another vessel till you see either her or her lights.' This is rank bad advice in some cases, for if ships' helms were never altered on coasts where there is a heavy up and down traffic till they saw each other, dozens of collisions would take place in every dense fog that now go all clear, by the coasting trade navigation being carried on as we have described.

Of course, if there is great doubt as to the direction in which a crossing vessel is approaching, try, by all means, if it is daytime and the fog is not too dense, to sight her before altering your helm; at any rate get all the way you possibly can off the vessel. But a crossing vessel's course can nearly always be come at pretty accurately by observing the bearing of the sound of his whistle at each blast, and at the same time studying the direction of the wind; although it must always be borne in mind that during fog, sound waves are often subject to be deflected by counter currents of air or wind between you and the object, and are therefore at times very deceptive. Always during fog study well the direction of the wind, as it has a very important bearing on the case.

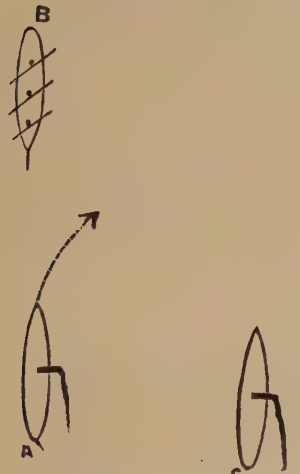
Experiments conducted by the Trinity some few years ago proved sound waves could be heard nearly as far *athwart* the wind as they could *before* the wind, but against the wind the ratio was very small indeed in comparison with the other two.

The greatest care and caution are absolutely necessary when a fog is accompanied by a strong wind. At such times steamers' whistles can only be heard at a very short distance, and sailing ships' fog-horns often not more than a couple of hundred yards, if that. Snow at night-time is often quite as bad as fog, especially when it is blowing in a horizontal direction, with a strong wind. At such times the writer has often known steamers' lights not visible one hundred yards.

In conclusion, we hope the young aspiring officer will take well into consideration our few remarks in this chapter, and that they may prove useful to him in emergency, as they are based upon the experience of two masters who have spent nearly a lifetime upon the deep; and we also trust our more experienced and older brother masters will criticise

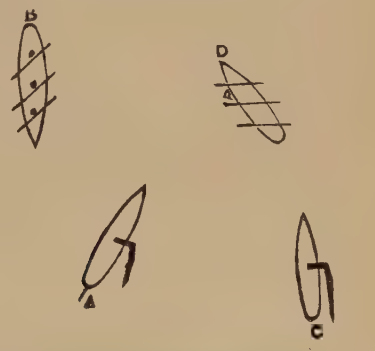
the matter as leniently as possible, especially so that part contained in the directions for manœuvring in foggy weather, as all seamen must own it is a very difficult matter to treat satisfactorily, for no hard and fast rules can be laid down how to act that will cover all a vessel's multifarious surroundings during the prevalence of dense fog.

*Plate No. 135.*—Accidents will happen.—A case off Dungeness.



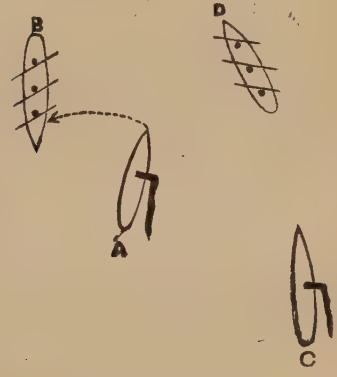

*A* ports to clear *B*, knowing he has *C* on his starboard beam going as himself.

1.




*A*, having steadied his helm, suddenly sees *D's* red light (*D* is shewing no stern light). *A* starboards hard, and later on goes full speed astern, hoping to come short round and clear *B* on his starboard helm.

2.




But *A's* head only goes off in direction of dotted line. He hits *B* amidships, and sinks her.

3.

* On March 31st, 1899, off Beachy Head, the s s "*Heathpool*" was run into during a dense fog and sank with the loss of all hands.

The master of the "*Heathpool*" was Capt. John Todd and he went down with his ship.

At the Board of Trade enquiry it was proved that he was free from blame, the way being off his vessel at the time that she was struck

## SECTION XLII.

## TAKING A SHIPWRECKED CREW OFF A WRECK.

If the weather is very bad, and the wreck is lying rolling about in the trough of a heavy sea quite helpless, to save the crew is no easy task to accomplish successfully; for many a gallant boat's crew of fine seamen have perished in the attempt to rescue their brothers of the deep. Therefore we will try to explain how this difficult job may be accomplished with as little risk as possible to a boat's crew.

We will assume you have a good steamer under foot, in good bad-weather trim, and that she is a handy vessel.

Firstly, run to windward of the wreck, going as slow as possible, give her a cant upon the sea, stop her, and lower down on your lee one of the lifeboats; mind, do not give her too much cant or she will turn athwart the sea, but just sufficient to keep the boat under the lee.

When the boat is in the water, with *two hands* in her, make a good long line fast to her, pass it through the bow ring, haul two or three fathoms through the ring, and hitch the bight round one of the mid-ship 'thwarts. Place in the boat a lifebuoy with fifty fathoms of new small heaving line (if it is a breeches buoy so much the better); *mind* and do not forget this buoy, for the saving of the shipwrecked crew's lives are depending upon it. One of the men must tend the boat-line with a round turn round the second 'thwart from forward, and the other man must ship and tend a long steering oar over the boat's stern, as boat rudders are of little or no use in keeping a lifeboat head to sea when she has no headway upon her.

The following three signals, or some similar simple code, must be thoroughly understood by the man in the bows, and he must be well cautioned before going in the boat that he pays strict attention to them, as the safety of the boat and the men's lives depend in a great measure on these signals being *properly observed.*

SIGNALS.

Cap held right above his head—Hold on the line aboard.

Cap at arm's length in right hand—Slack away the line aboard.

Cap at arm's length in left hand—Haul in the line aboard.

I must again caution the reader that these or similar signals must be strictly adhered to, and if they are, it is next to impossible that the boat will come to grief upon the wreck; but pick out a *smart*, trustworthy, good seaman to be placed in the bow of the boat.

The boat-line on board the ship must be kept in the hands of 7 or 8

men, with one holding on behind a bit, and not be taken to a steam winch; it then can be veered or hauled upon at a moment's notice, as we will presume, at such a critical time, an officer is standing on the taffrail with a pair of glasses in his hand, intently watching the movements of the man in the bow of the boat, and will give his orders quickly to the men tending the boat-line as the occasion requires.

All being now ready, drop the boat under the stern, and place your vessel in position, viz., head to sea, and dead to windward of the wreck, at a respectable distance from her, say 200 yards, or as far as your boat-line will admit of.

A new coil (or two bent together) of 3½ in. rope is a good size for this manœuvre; but have another coil ready to bend on to this, in case the ship gets a little misplaced during the time the boat is going down before the sea on the wreck; and mind as you slack her away *keep pouring a considerable quantity of oil* into the sea over your stern, as this will contribute much to the success of the operation.

When the man in the boat holds his cap straight above his head, hold on the line, and watch his movements well, as it is quite impossible for those on board the ship to tell with exactitude the distance the boat is from the wreck, and you must now be entirely guided by the signals before mentioned.

As soon as you see a sufficient number of men are in the boat, as regards her safety, give the whistle a blast, to signify that you are about to haul the boat alongside, and when doing so be careful you do not give her too much way against the heavy sea. When the boat is close up to the stern, give the ship a cant to bring the boat on the lee, and get the men safely on board.

During the time your vessel is to windward of the wreck she wants carefully nursing with the engines to keep her head to sea, and it is an anxious time for the master; but if he succeeds in saving the poor shipwrecked men, he is doubly paid for the extra anxiety.

When the boat is close to the wreck, and the two men who are in her consider it not safe to approach any nearer, if the sea runs clean over her, then the man in the stern of the boat bends on the lifebuoy to the middle of the heaving line, throws one end of the heaving line overboard along with the buoy, and it floats down to the wreck; the men on the wreck then get hold of the end of the line that was thrown overboard along with the buoy, and the shipwrecked men can be transferred from the wreck to the boat in the buoy with comparative safety.

But, it may be said, suppose the shipwrecked men are so exhausted they cannot help themselves, what then?

Why, simply the same means must be adopted as is put in practice by the Life Brigade on our coasts. A man must volunteer to go down in the buoy to the wreck, so in this case it would necessitate the boat returning to the ship for an extra hand, and that hand must be the volunteer. Although it would be a hazardous duty to perform, I feel certain in my own mind that amongst a ship's company, in that hour of need, a gallant fellow would step out, as volunteers to save life have ever done at sea.

After the shipwrecked men are all on board, steam your vessel clear of the wreck; give her a cant to bring the sea on the bluff of the bow, and hoist the boat upon the lee.

In going to leeward of a wreck there is often much wreckage floating about, that might foul your propeller, and endanger the safety of your own vessel; but if you have determined to risk a whole boat's crew's lives to save the shipwrecked men, then run your vessel a little to windward of the wreck's stern, give your vessel a strong cant, and lower the boat on the lee, manning her as quickly as possible, and see that each man has a life-belt on. The boat's crew, after getting clear of your vessel, must then drop the boat down under the lee of the wreck, keeping her head to sea as much as possible. After rounding the wreck's stern and getting under the lee, then take as many of the shipwrecked crew into the boat as she can carry with safety.

While the boat is under the lee of the wreck, run your vessel well to leeward of the wreck, so that the laden boat can again drop down head to sea towards your vessel, and get underneath your lee, when the shipwrecked men can be easily got on board.

If there are still more of the crew on the wreck, make two lines fast to the lifeboat, one on each quarter. Let the boat's crew all come out of her, and tow her to windward of the wreck, repeating the evolution as described above till all the crew of the shipwrecked vessel are saved.

Letting the boat drop down head to sea, with the boat's crew tending her with their oars, just giving a stroke now and then to keep her head to sea, minimises the risk immensely of a heavy sea overpowering the boat.

Always be careful on going alongside of a wreck, as she might be on the point of foundering, and have your oars all ready when alongside of her, to back the boat off at a moment's notice.

Allow no baggage to be placed in the boat till all the shipwrecked men are in, then you can judge if it is prudent or not to save the men's effects. The writer once saved 17 men in a vessel's lifeboat, and had the baggage not been thrown overboard the boat would have foundered with all hands.

It requires great care in lowering an ordinary ship's lifeboat in a heavy sea. Before commencing to lower her, see the painter is well fast on board the ship, and that two cork fenders are secured to the boat's inner side, so that they cannot jump up whilst lowering the boat,* and be careful to unhook the after tackle first, and bow tackle as soon as possible afterwards.

If the boat gets a long distance from the ship before you can pick her up, and the crew find with her being deep the sea is likely to overpower her, they should take a couple of the oars and make a bridle with the boat's painter fast to them, and heave them overboard; this, with the assistance of the steering oar, will keep the boat head to sea. Then let her drive in this manner till you can steam your vessel up to windward of her and pick her up.

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## SECTION XLIII.

## COMMON PILOTAGE AND COASTING SEAMANSHIP.

This subject is of the greatest importance. Probably more than two-thirds of our yearly losses are caused by strandings. In these days a steamship master in an all-round trader has to be a pilot, we may say, for the whole world, and only constant, unceasing vigilance will save him from mishap. Notwithstanding the immense importance of this subject, it is not treated on in works on navigation, which is the excuse, if any be needed, for remarking on it here.

Looking at the wreck chart of the British Isles that is published annually, one is surprised to see so many strandings; but when the great traffic that goes on round our coast is taken into equitable consideration, the number of strandings is not so large as might be imagined, taking into account the great number who go all clear.

The casualties may be chiefly attributed to two causes—firstly, Course not made good; secondly, The ship ahead of her reckoning, and carelessly allowed *to run too long* without taking a cast of the lead.

Therefore, when coasting, the master should above all things exercise the greatest vigilance and care to guard against these two sources of danger.

Now we will consider the first of these two causes of strandings, viz.—Course not made good. This is due to four causes—firstly, in

* Many vessels have two large fenders fitted for the purpose, with two lanyards in them, one lanyard being passed underneath the boat's keel to prevent the fender jumping up whilst lowering the boat, if a sea comes up under the boat's bottom before the tackles are unhooked.

many vessels, to a cheap and unreliable compass, badly placed and carelessly adjusted; secondly, the corrections of this compass, or its errors, being imperfectly known to the master, or at least not with sufficient accuracy to keep him out of trouble—and often matters are made worse on this head by his never taking azimuths to ascertain the necessary corrections; thirdly, from not studying the rate and the set of the tide; fourthly, bad steering.

NOTE.—Before coming into any channel, or on to any coast, it is always prudent to get some azimuths with the ship's head on the courses you will have to steer up the channel or coast, as when you get there it may be thick, and you will then have no chance of knowing how your compass really is. This is as necessary with a ship newly compensated as at any other time. In smartly navigated vessels the course is always given in degrees. This should be done in every steamer, and especially when coasting. If a man gets a course given him to a quarter point, he thinks he is doing well if he steers within a quarter point; but if he has to steer, say, N. 47° E., he is much more likely to steer within a degree of it.

The first cause may be said, in some degree, to be out of the power of the master to rectify: but not entirely so. The second cause is nearly always avoidable; and it often unfortunately happens through the laxity of the master (viz., in not taking azimuths) that this leads to so many strandings. The third cause, viz., not allowing for the tide, is in many cases due to ignorance of the subject, and, until the last few years, to the want of a ready book of directions plainly shewing the set of the tide. (This want, I may add, is now supplied by Capt. Whall's "Handy Book of the Tides," in which the direction and run of the tides all round the British Isles and in the North Sea can be seen at a *moment's glance.*) And as the tide is one of the most important factors in coastal navigation, especially in vessels of small power and speed, its neglect contributes to many strandings.

A fruitful cause of course not being made good is bad steering. Officers should be most careful to watch the steering in their watch, especially during hazy weather, or at night, and endeavour to estimate with accuracy what course has been made good, and if the ship has been let run considerably one way, which is often done by careless helmsmen, to be particular in letting the master know. Again, if many ships on the opposite course have been passed during the watch, and the helm has been altered for them often, the ship will possibly have been run considerably to starboard of her course, and the master should be informed of this before the next point of land or shoal is approached.

NOTE.—Steamers with right-handed propellers (as nearly all are) will be found to run to the port side of their courses, through the propeller's action. Thus, in the

English Channel, bound *up* channel the ship will be found to come *in shore* of her course, bound *down* she will be inclined to run off shore, supposing always that no other elements counteract the screw's effect.

Now let us consider the strandings that occur through the ship being ahead of her reckoning, and neglect of the lead, and how this can be avoided, or at least minimised to a certain extent, giving also a few general hints to the coaster.

We will presume your vessel is drawing in to the land, on a coast beset with dangers, on which there is a heavy traffic.

If the weather is moderate and clear, leads and lines must be seen in their places ready for action. Hoist your working boat into the davits, swing her out, and see oars, rowlocks, &c., are in their respective places, and see all the other boats are ready for lowering at a moment's notice, and all the gear connected with them, such as life-belts, &c., are in their proper places. See the anchors all clear, and the windlass in good working order. If you have a strong breeze aft, and are using North Country coal, let the engineer see that his firemen fire little and often; this will greatly reduce the blinding smoke, which is often as bad as a fog. This is a standing order in some firms, and is a very important thing.

Have the coloured relieving lights well trimmed, and lit if it is night time, as one of the working set might go out at a critical moment. Place the stern light all ready to show when required, and have a couple of rockets and blue lights in a handy place on deck, ready for emergency if wanted in a hurry. For now that the coast is aboard, and you are amongst shipping, you must exercise great care, for with all your vigilance and caution you may come to grief, possibly through lubberly conduct on the part of those on board other ships.

Now we will assume you have made some point, or well-known headland, ascertained your distance therefrom by a 4-point bearing, re-set the log, consulted the chart, and laid off a safe course; you are then in a fair position to keep out of trouble, as long as the weather keeps clear.

But if the weather turns foggy, it then becomes quite another question; double vigilance and care must be used both to avoid stranding, and also collision. Firstly, double the look-out on the forecastle, keep the vessel out at least half a point further from the land, sound the whistle *at least* every two minutes, giving it *one long blast* each time of about 5 seconds duration. Never blow more than one blast on the whistle, for remember this is *the fog* signal for a steamer under way,

viz.—*one long blast.** Ease the engines down to half speed; if the fog is dense, to dead slow, just sufficient to keep steerage way upon the vessel. Stop the ship every now and then, *and take a cast of the lead,* to see you are not set in towards any dangers by indraughts of the tide; for, the vessel going slow, the tide has a greater effect upon her, and you may easily get the ship misplaced many miles if the fog continues; so pay great attention to the soundings, and frequently consult your chart to see that they agree. In running from point to point it may be taken as the rule that you will be swept *into* the bights by the tide, so it is very necessary to keep at the proper depth by the lead. Atherfield Ledge, Isle of Wight, has brought up many a steamer through this cause.

In some places, as for instance approaching the Weser on the N. German shore, it saves time to use the lead thus. Take a turn with the line somewhere about the bridge at the depth to which you intend to keep in; say you want to run along the coast in 16 fathoms, then have enough line out to give you a 15-fathom cast, arm the lead, and every now and then carry it forward and drop it overboard, then if you are inside your line of soundings the arming will show it by bringing up a sample of the bottom. With this method it is only necessary to slow down sufficiently for a cast, and the ship has not to be stopped dead every time, and will thus make a better course.

If you are in a position on the coast where you can lead the vessel into an anchorage out of the line of traffic, with safety, and the fog is dense, *by all means* do so, as you will by so doing bring the risks of stranding and collision to a minimum. Do not be afraid to let go the anchor in an open spot, as it seldom comes on to blow hard as long as a dense fog prevails, and if it did you would always have time to pick the anchor up before the sea got very heavy, as it is presumed under such circumstances the sea watch would be on deck, and a bright look-out kept by the officer of the watch.

But say you have concluded to go on. *Never* let your vessel run far between casts of the lead, and mind one cast may be misleading; it is always prudent to verify it by a second every time the ship is stopped, for by the action of the tide it is impossible for the lead to fall *exactly* in one spot, and it might chance to fall into a cleft or crevice on the bottom, not marked on the chart, and deceive you a few fathoms. Lately some shipmasters have been found bold enough to decry the use of the lead, but any old and experienced coaster will tell

* Remember that under the new Art. 15, a steamer *with no way on her* sounds 2 long blasts.

you that it is your only hope of salvation in dense and continued fog. Of course if Sir W. Thomson's sounding gear is aboard, so much the better for the saving of time and being able to steer more reliable courses; but whether it is or no, down *must* go the lead if you would keep out of danger.

To navigate around the coasts of Great Britain, or that part of the Continent enclosed by the North Sea, in winter time, amongst heavy traffic in foggy weather, is, to say the least of it, a very arduous and anxious duty for the shipmaster; and I think all old coasting masters and navigators of experience will bear me out in what I have said before in these directions, that if it is at all possible in a dense fog, *bring your vessel to an anchor*, both on account of stranding and collision; and no seaman can feel himself justified in plodding on in a fog if he is not quite sure of the vessel's exact position.

Of course, under certain circumstances, he may be justified to a certain extent; thus, if he is close to his port of destination, and has been able to fix his vessel's position with great exactitude by a fog siren on some well-known headland, or on board of a light-vessel, and has only a short distance to go until he gets into comparative safety under the guidance of tug steamers and pilots, he may then be justified in creeping his ship slowly into a port of safety. Yet even under these circumstances, after all things are duly considered, he runs a pretty tidy risk of getting into trouble by collision with other vessels coming out of harbour as he is proceeding in, even if the fog signals keep him from running ashore.

On first hearing a fog siren be careful how you act, for under certain conditions of the atmosphere sound is very deceiving. When you first hear a siren, always try and verify its position and that of your ship by the lead; especially as, unfortunately, some steamers use them in place of whistles.

If you are anywhere in the vicinity of high land, give your whistle a sharp blast, and listen for the echo against the cliffs, especially if there is no wind. Sound travels, roughly speaking, about a mile in 5 seconds; anyway, that is a near enough calculation for the present consideration; but it unfortunately happens that this echo can be heard one night and not another, according to the state of the atmosphere for conveying sound, and also the direction and force of the wind. Yet it is as well to try it on a foggy night, so that you leave no stone unturned to ascertain the position of your vessel.

I was once off Cape Antifer, steering for Havre, on a hazy, dark night, and having seen nothing, I stopped the engines and gave the

whistle a quick blast, preparatory to having a cast of the lead, when I heard the echo resound with great power; I then again blew the whistle, and counted seconds, the echo reached me in exactly 6 seconds, so I knew by that we were very close to the cape, and hauled off accordingly. A few minutes afterwards the haze lifted, and I found we were close to the high land of Antifer, but the vessel was then heading broad off, and quite safe. I merely quote this as an example to show how valuable the echo may be to a seaman in thick weather, when the atmosphere is in good condition for the conveyance of sound.

In coastal navigation the rule is, when possible, make all points, capes, headlands, and light-vessels as you pass them, then you have only a short departure if it comes on thick.

Keep a black painted log board on the bridge, and see the officers note down on this board what the log registers at every point of departure, and the distance the ship is from it by the 4-point bearing If the object is past the 4-point bearing when you first observe it, then take a 5-point bearing; the way to apply this last is easily remembered without reference to any tables. For every mile the ship runs from the time the 5-point bearing is taken till the object bears abeam, the ship is $1\frac{1}{2}$ miles distant from the object when it becomes abeam; thus, to put it plainer, say the ship runs 4 miles from the time the object bore 5 points on the bow till it was abeam, then the distance the ship was from the object when it was abeam would be four times $1\frac{1}{2}$ miles (namely, 6 miles).

Get the officers once into the habit of taking these bearings and recording them on the board, and in course of time it becomes quite natural to them, and is a great source of comfort to the master if it chance to drop down thick. These bearings are sometimes reckoned from abeam, in which case the last would be termed a 3-point bearing.

NOTE.—Another useful problem is as follows: "Doubling the bow angle." Suppose you sight a buoy or lightship 2 points on the bow, take its bearing again when it is 4 points, and the distance you have run between the two times is your distance off the object at the last bearing.

A shut-up blackboard, fitted like a log slate, and a piece of chalk, are far before any pencil and slate business, as a man can feel a piece of chalk on a frosty night, when a pencil would be entirely useless.

If intending to pass a point close, learn in the first place how far the dangers, if any, project out seaward. Then take its bearing on the four points, and if you find, by the time, as you get it nearly abeam, that you will be rather close for safety, *never hesitate for a moment*, but haul her broad off *at once*. Some young men do not like to do this from a false sort of fear of being thought over cautious. Never

let thoughts of this kind influence you—it is better to be sure than sorry, as our old sea proverb has it; and remember that at short distances sight alone is a fallible guide, and not to be depended on, for a point will appear much further off in some states of the atmosphere than it really is, and *vice versâ*. Remember also that, in close shaving of this kind, you must allow for the tide in your distance whilst running the four points.

But though this close shaving may be practised with impunity by experienced coasting hands, the young officer should not attempt it. A mile too far off is better than a fathom too near.

In foggy weather warn the engineer on watch, tell him on no account to keep too strong a head of steam, as in all probability you will have to stop occasionally for a cast of the lead.

And what is more obnoxious to a seaman, and even at times a source of danger, when the master and officers are listening attentively to hear some siren or fog-horn, or perchance another vessel's fog signals, than to hear the steam suddenly start to roar up out of the steam pipe, and continue to do so for perhaps ten minutes, deadening every other sound in or near the ship.

Also in foggy weather the engineer on watch should never leave the engines for a moment.

Fog sirens and horns on headlands are not always to be trusted to, especially so if they are to leeward of your vessel; and on many of the headlands on the coast of England the Trinity Board have discarded them, and in their stead use explosive rockets ascending 600 feet before they burst.* Mr. Arnold B. Johnson, Chief Clerk of the U.S. Lighthouse Board, issued in 1881 the following useful hints as to the use of fog signals:—

"When approaching from windward the fog signal is picked up earliest aloft; from leeward, on deck. Do not assume that you are out of hearing distance because you fail to hear the signal, nor that you are at a great distance because the sound is faint, nor that you are near because you hear it plainly.

"Do not assume that you have not reached a given point in your course because you do not hear the signal with the same intensity as on some former occasion.

"Do not assume that the signal has ceased sounding because you fail to hear it even when within easy earshot.

* In a siren with a high and low note, the low note will often be heard alone, the high sound not reaching the vessel. It has been so often reported to the Trinity House that a station has been passed without the siren being heard, that tell-tales are now fitted in these stations which record the time of every blast of the horn.

"Do not assume that the aberrations of audibility are the same in different fog signals.

"Do not expect to hear the signals as well as usual when the upper and lower air currents run in different directions, or when wind and tide do so, or during a time of electric disturbance, or when the sound must reach you from over an island or point of land.

"When there is a bluff behind the signal, be prepared for irregular intervals in audition, as would follow were the sound to ricochet like a cannon ball; thus you might hear it at 2, 4, 6, 8, &c., miles; and lose it at 1, 3, 5, 7, &c., miles, or at any other combination of distances, regular or irregular.

"And finally, do not suppose that because a fog signal is faint you *must* be far away from it; it *may* be comparatively close.

[Signals near sea level, such as Lightships, and Dungeness Point signal, are seldom missed; elevated signals, on the other hand, may often be passed and never heard at all.]

"Until the laws governing these aberrations are evolved, and a method is discovered by which the irregularities can be corrected, you will do well, when you do not get the expected sound of a signal, to assume that you do not hear the warning that is nevertheless faithfully sounded, heave your lead and use other means to make sure of your position."

It is prudent, if you get into shallow water unexpectedly in a fog, and cannot tell exactly the position of the vessel, to drop the anchor under foot, and give her just as much chain as will hold her till it clears up; for in trying to get into deep water you may run hard and fast ashore, as you may be embayed, or between two shoals, so it is best to let her remain at anchor till it clears.

Be wary of approaching vessels, and don't shave them closely by day or night. Be also careful when coming to a point, such as the Royal Sovereign or Longships, where you may require to alter your course to a large extent, that there are no vessels coming the opposite way, who, when they alter their course, will be likely to come to close quarters, for though you may be careful, you will always meet others who are not so.

Trawlers may be treated as vessels at anchor; they never have much way over the ground.

With drift-net fishermen be careful to pass on the side to which they wave you with their flare-up, or else you will probably foul their nets, and perhaps bring up your engines all standing, besides causing great expense to poor fellows who are ill able to afford such loss.

Learn all you possibly can about the bottom from your charts in clear weather; such as, the guide it gives for clearing the Smalls going north, the chalk belt in Dover Straits, the regular shelve of the shore between Borkum and the Elbe, etc., etc. It is ignorance or neglect of common pilotage which loses the greater number of our steamers year by year.

Be sure your officers know the lights you expect to sight, and their fog signals, and do not give a young stranger too much charge.

Be careful in making a flashing light after a run of any length, that you are sure what light it is, for at one part of our coast now there are a dozen flashing lights in a distance of thirty miles, and it is very difficult in many states of the atmosphere to decide which light out of the number is in sight, and often a mistake would be fatal. This multiplication of flashing lights is an error.

Be careful, should the course be altered *in* shore for any purpose, such as shortening sail, that the ship is not run in too long, and that *ample* allowance is afterwards made by hauling out again.

## SECTION XLIV.

## STRANDED.

If you should be so unfortunate as to get your vessel stranded on a sandbank, of course first try to back her off with the engines; but if you find the tide is falling fast, immediately stop them for two reasons, firstly, it is useless if the vessel has sued, and secondly, the injection rose in her bottom will take in great quantities of sand, and cause the machinery to get clogged with grit, rendering the engines totally useless, and they will eventually refuse duty and come to a standstill; and if this is the case they will have to be taken to pieces and the sand cleared out of the internal parts of the machinery before they will work again.*

Now this is a very important feature in the case to pay attention to, as the next high water you will require the engines in good form to assist you in getting the vessel afloat; therefore the engines must be as carefully nursed as possible, to prevent them getting sanded up.

In some cases, if the vessel is stranded in a position where a good flow of water may be expected on the next flood tide, especially if it was near low water when she stranded, it might be found prudent to

* The S.S. *J. Y. Short* stranded at Tunstall (23rd Oct. 1892), and through working her engines in the hope of getting off, they became choked with sand and useless.

let a little water run into the engine-room bilges, or into one of the ballast tanks (if the vessel was cargo laden) at that end of the ship where she is drawing the least water, or at the end of the vessel at which the deepest water is to be found, and inject the engines from this. But if you grounded near high water time, you would require every inch of water you could get to float the vessel, and in such a case this course would not be prudent, as the ship would then require more water beneath her bottom to float her than there was when she first stranded, by the extra weight of water you put into her.

It very often happens that when vessels get stranded about the coasts of Great Britain or the Continent during fog, that moderate weather prevails. If such is the case, directly you find she is hard and fast, out with the jolly-boat, and sound carefully round the vessel; then go to your chart, and study well the set of the tide over the shoal; you have then ascertained the direction in which the most water lies, and the assistance or otherwise you will receive from the run of the flood stream.

Then run out your stream anchor, or large kedge, in the required direction, with a couple of good handy wire hawsers fast to the anchor, so that you will have a long scope of rope out when it is taut from the anchor to the ship, and thereby not endanger the anchor coming home. Buoy the anchor, in case the ship comes off hurriedly and you have to slip it. Heave the kedge rope dead taut at low water, and when the tide is well flowed, and the ship begins to move in her bed, get a strong head of steam up, heave away the kedge rope, and put the engines full speed ahead or astern, as required, and if she has not been run ashore going full speed near high water, in all probability she will draw off the shoal.

But if she has been run ashore going full speed at the top of high water, in all probability great difficulty will be experienced in getting the ship afloat, as she will have run herself a long way up, and in this case a mere kedge and wire rope will be of no use.

Under such unfortunate circumstances cargo must be at once jettisoned as fast as possible, as every moment is valuable, for bad weather may set in at any moment. If the weather clears up, up signal (presuming it is daylight)—"Want immediate assistance"; if it is night time, keep sending up a rocket every now and then, or better, if you have a carronade fire it off once every minute, if you are in a position where you may expect assistance.

If steamships or tugs come to your assistance, endeavour to procure their services if possible, but make no agreement for remuneration if

you can avoid it—that part of the business is better settled by the owners of the respective vessels, or by arbitration; but no matter *what turns up*, engage the assistance if possible, as the whole value of your ship and cargo is at stake, for 6 hours' bad weather will probably find your vessel a wreck.

Of course in these directions it is supposed that your vessel is not holed, and makes no water.

If she has been run on a rocky bottom, it always unfortunately happens that she is holed, and fills with water, when strong salvage operations become absolutely necessary; and unless these are *promptly* rendered, it is out of the power of the crew to save the vessel.

If your vessel gets stranded on the mainland, and assistance is procurable at once, act promptly, and with *decision.*

If it is near the entrance of a seaport, waste no time running about offices, telegraphing home for orders what you have to do, etc., for you *yourself* are in the best position, assisted by the advice of the port officials, to know what is best to be done to save the ship and cargo.

At once engage a tug or small lighter, and run your bower anchors and cables out to seaward, and heave them well taut, taking the ends of the cables on board either aft or forward, as the case requires; this prevents the vessel dredging further on shore every flood tide, and stops her turning decks to seaward, if she does not come off till spring tides.

Many a fine vessel would have been afloat to-day, that became a total wreck, had this simple precaution been taken when she first went ashore.

Try by *all means* to get her afloat on the next *high water* after she strands. Engage plenty of towing power if procurable; remember one tug too much is better than one too little. Underwriters and owners will not blame you for acting with promptitude and decision. Such cases demand great energy and resource on the part of the master, but unfortunately at these anxious times the master is often low in spirits, and downhearted—naturally so—by his vessel getting ashore, and is quietly waiting for instructions from home by telegraph how he is to act.

The people in authority at home know nothing of the vessel's actual surroundings, so in hot haste dispatch a salvage official to the scene of the disaster. In the meantime, while this individual is coming to the ship, old Boreas gives a wintry blast on his sea horn, and the salvage official very often arrives to find her turned decks to sea, a total wreck, and all this often arises through the master not taking preventive measures when the vessel *first* got on shore.

At such times the master requires to be very firm, and show all the fortitude in his character, as the salvage fraternity at all the outports presume he is in great trouble of mind, and lay their plans accordingly.

A British shipmaster must *never forget* for a moment at such times that *he*, and *he alone*, is the responsible agent for both ship and cargo, and that no Lloyd's agents or *any* other authority can divest him of that power, without they hold in their hands a legal *Power of Attorney*, attested by his owners, to empower them to act on behalf of the ship.

If a steam vessel gets stranded on a falling tide, in ballast trim, do not start to pump out the water ballast till you have run out your kedge, and hove a good weight on it, or she may saddle herself further on the shoal by the heave of the sea.

When the kedge rope is fire-tight and well made fast, out ballast as soon as possible if moderate weather prevails, and if she is not holed, and has not stranded near high water time, she will probably back off during the next flood tide.

## RAISING SUNKEN VESSELS.

Vessels sunk, or partly so, in different positions, and holed in different parts of the hulls, require separate treatment in raising them, and each individual case is generally a complete study in itself.

We will therefore, in writing a description of raising sunken vessels, cite three distinct cases of such, as a short illustration of what might fairly be termed a profession in itself, viz., ship lifting.

Firstly.—Where the vessel is partly sunk, and stranded.

Secondly.—A case in which the vessel is stranded on an exposed beach, with all holds full of water except the engine-room, the vessel being taken off the beach into a place of safety, and temporarily repaired by the master and his crew, with the assistance of some fishermen.

And lastly.—A case where the vessel is entirely submerged, and lies in deep water, when strong salvage operations are absolutely necessary to lift the vessel.

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The steamer A., Capt. Rollo, having run ashore in a dense fog during fine weather, on stony ground, in an open bay near the entrance of a seaport on the coast of Spain, energetic and prompt action was at once taken by the master to get the vessel afloat, in case bad weather set in and wrecked the vessel.

Capt. Rollo was only a young master, yet he was endowed with plenty of nerve and energy of character. Some time previously, when

in London, he heard an old ship lifter of great experience (who had been many years at that occupation in the employ of the Thames Conservancy) remark that the *first tide* after an accident was *the tide* above all others to endeavour to float a sunken vessel, provided the necessary arrangements for lifting the ship could be got ready in time.

Therefore Capt. Rollo determined in his own mind, if possible, to carry out the old ship lifter's good advice, and acted accordingly.

The steamer A. was tight in all her holds except the No. 1 lower hold; this filled up to water level shortly after she struck, consequently the locality of the leakage was known to a certainty.

Capt. Rollo at once made an agreement with some fishermen to run both bower anchors and cables out to seaward of the vessel, the entire length of each cable. As the vessel was lying with her bow towards the shore, the ends of the cables had to be taken in aft. The agreement he made with the fishermen was that if the cables and anchors were properly run before low water, they were to receive £25, at half flood £15, but if high water before it was executed, or after that time, only £10.

The second officer was now landing all the valuables belonging the ship, chronometer, &c., and the crew's effects, placing them in a fisherman's hut on the beach, and an armed seaman was left to watch them.

The chief officer and the rest of the crew were assisting the fishermen with the cables and anchors.

So Capt. Rollo pulled on shore, and employed four lighters and a hundred men to go off *instanter* with a tug and lighten the vessel in the No. 1 and No. 2 holds, the A. being about two-thirds loaded with a general cargo. He also engaged three powerful tugs at £20 each for the following tide if the vessel floated; if not, £10 each. The tug owner fought hard with Capt. Rollo for more money, without success. As there were other competitors in the tug ring, the owner quickly closed the bargain, promising faithfully his tugs should be alongside of the A. before next half flood.

Capt. Rollo, although labouring under intense excitement, tried to hide it as much as possible from the gaze of both his crew and the shore-going fraternity of salvors; the latter class he knew would take every advantage of his unpleasant situation *if they got a chance.*

So he held himself aloof from several kind gentlemen who proffered their services to get his ship afloat. Another forward functionary, who called himself a club surveyor, Capt. Rollo kept at a respectful distance, informing him that his club had no lines on his vessel, and that he was a small shareholder in her himself.

Capt. Rollo well knew that no proper appliances were at this port for ship lifting, and that no specialists as salvors resided in the locality, so he considered that to a great extent he would be hove upon his own resources to float the vessel. But stern necessity being the mother of invention, he had high hopes of accomplishing the task unaided by salvors, who probably were long-shore men; and he considered, as a true British sailor, that his knowledge of such work was infinitely superior to that of any Spanish landsmen, so he bid them good day politely, as he never made enemies when he could avoid it, especially so when he was in trouble, and popped up to the telegraph office and wired these words home to his owner:—"A. on shore. No. 1 hold full of water; energetic measures taken; expect float next tide; letter follows; will wire to-morrow."

Then he hastened off to the vessel, as it was now drawing towards low water. He found, on getting on board, considerably over 120 tons of cargo was already in the lighters, and that the fishermen had finished with the cables; he found them as taut as a harp string, set up with luff upon luff by the after steam winch, and properly secured. He also found the engineers had rigged three temporary hand pumps down the No. 1 hold, having drawn them out of the after holds, and all the officers and crew were busy shoring the No. 1 bulkhead in No. 2 hold.

The chief engineer's ruddy face seemed to say to Capt. Rollo that he held high hopes of floating her, as he and his "second" were getting the fore winch temporarily fixed to work two of the before-named hand pumps; and he informed Capt. Rollo they would be all ready at low water, so that with both donkeys and the extemporized pumps they could heave a great body of water out of the No. 1 hold.

All things looking up so well, Capt. Rollo walked into the chart house to quietly think matters over, till the young flood bent, as every minute to him seemed ten.

He concluded that if the water rose in the No. 1 hold very fast with all the pumps going full bore, he would be compelled to take more effective means to raise the vessel than were at present in force; but if the water only rose slowly in the hold, then he would try to heave the vessel off the rocks, and beach her in the small seaport before mentioned. So it all depended now, under the present arrangements in force, if the pumps could keep the water down to a reasonable extent for an hour after she floated; in that case he would risk all, and heave the ship off, as there was every indication of unsettled weather setting in.

He also determined that if he found the vessel too deep forward to be manageable when she floated, he would harden her up again in her

old place till he rigged better appliances than were now in force to lift her. After weighing these matters carefully over, he walked forward, and just then the chief officer reported it to be dead low water.

All the pumping power was now set away full bore, and Capt. Rollo could see with great satisfaction that his good engineers were doing their utmost to relieve the No. 1 hold by the continuous stream of water the pumps were throwing.

At half flood the water had risen nothing above low water level in the No. 1 hold, shewing conclusively the pumping power was sufficient to keep the vessel free whilst she lay on the ground. About this time, namely half-flood, the tugs came alongside and passed the towing hawsers, and every available hand about the decks clapped on the luff upon luff falls, that had previously been placed on the cables to assist the steam winches.

The chief officer was stationed down the fore hold with a lath, properly marked, watching intently the water level.

The tugs were now exerting all their power on the vessel, it being now three-quarters flood, and the cable chains were as tight as a harp string, when the vessel began to waddle.

Capt. Rollo immediately flew on to the upper bridge and struck the telegraph full speed astern; when the engines had got good way upon them, the vessel drew gradually out of her bed.

The captain then stopped the engines, and ordered the tugs to avast towing, and let the vessel remain in a position afloat till it was ascertained to a certainty that the water in the No. 1 hold would not overpower the pumps. In ten minutes it was found the water gained on the pumps one inch, so Capt. Rollo at once ordered the cables to be slipped, and in about three-quarters of an hours' time, under the guidance of a good pilot, she was carefully conducted into the small seaport before named, and landed safely upon a good beach, ready to be temporarily repaired, and then placed in graving dock.

Capt. Rollo's troubles now were nearly over, so he slipped up to the telegraph office and sent the following wire to his owners in England: "Ship floated to-day; arrived Santona; expenses incurred £175; letter follows."

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The steamer B., Capt. Ben, 1,000 tons register, laden with coke, after striking upon a sunken wreck, was run upon an exposed beach to prevent foundering, about 5 miles from the entrance of a small seaport on the coast of America, at night time during moderate weather, the tide at the time being half-flood, the rise and fall during springs at the place being 13 feet, at neaps 9.

At dawn Capt. Ben surveyed the position of his vessel, and found her landed on a beach composed of large gravel and sand.

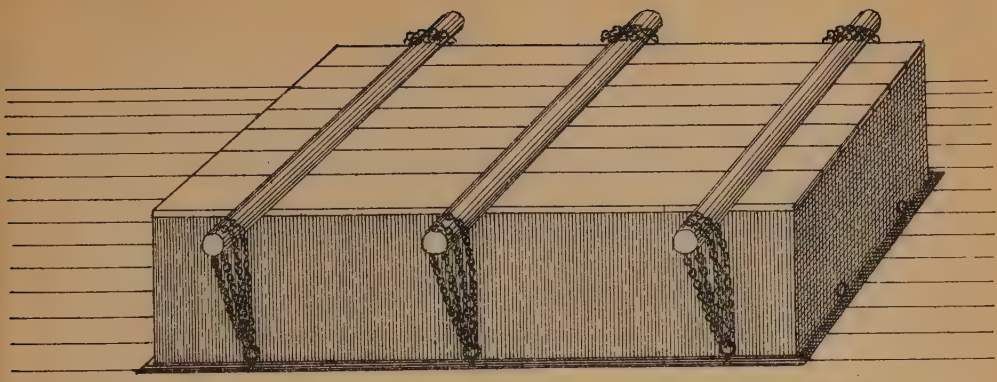
Unfortunately the vessel was holed in both the No. 1 and after hold, and through the No. 1 bulkhead not being watertight, the water was on a level in both the forward holds. Luckily the ship was not holed in her engine and boiler-room, and although the engine-room bulkheads were leaking considerably, the small donkey kept the engine-room clear of water. At high water the tide rose on a level with the upper deck, and at low water she sewed to her ten feet marks forward and aft, as she laid broadside on to the beach.

The situation appeared very unpleasant to Capt. Ben and his officers, especially so at the top of high water. So he called his engineers and officers together, and told them if the weather held fine he intended to try and float the vessel. He carefully laid his plans before them, and distinctly told them if they had any suggestions to make, either now or afterwards, they would receive his earnest attention, as he implicitly trusted they would exercise all the energy and resource they were capable of, and help him to save the vessel if possible. He also stated that, in his opinion, if the weather was favourable, and things turned out as he was led to expect, the steamer B. would be afloat in three days' time if all hands worked with a will. This declaration on the part of their captain seemed to instil new life into both officers and engineers, and they promised to do all that laid in their power to save the vessel; and Capt. Ben could see by their faces that what they said *they meant.*

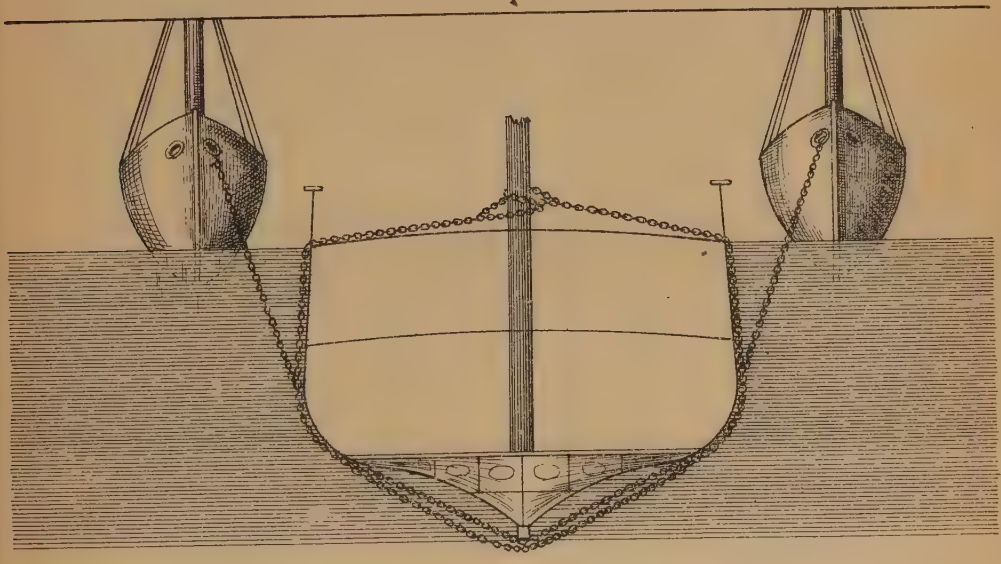
The chief officer was at once despatched with a few pounds in his pocket and a letter of credit to the small seaport, distant 5 miles, to engage four large lighters and several hundred empty oil casks; the latter named articles were plentiful in the locality, as they were stranded near a hive of the petroleum industry.

As the ship was holed under her flats, as I said before, in the No. 1 and after holds, Capt. Ben considered to try and get at the leaks from the outside of the vessel was impossible, as she laid hard upon the beach. So he ordered the crew to jettison the between deck cargo as far down as the water would allow them, and work as far down in the side of the vessel that was inshore as much as possible. The second officer had been sent on shore, and procured the services of about 100 fishermen from a village close by, at 10s. a day per man, and the cargo was being jettisoned very fast indeed.

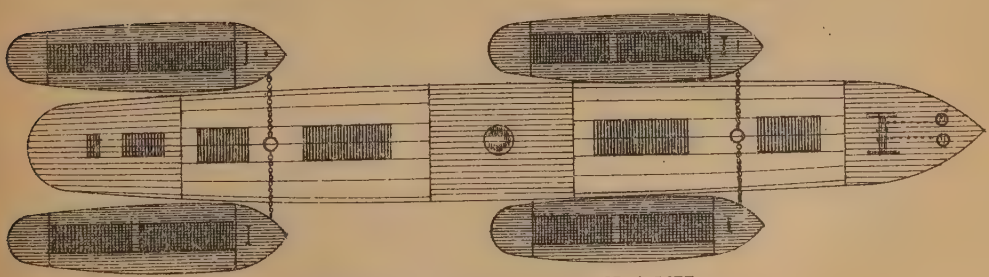
Capt. Ben determined not to run the anchors out to seaward till the next day, as it would take at least 5 or 6 tides before he was in a position to float the vessel.



SHOWING HOW THE HATCHES WERE SECURED WITH PLANKS AND SPARS.



HOW THE SLING CHAINS WERE PASSED.



LIGHTERS IN POSITION. READY FOR A LIFT.

During the latter part of the ebb tide the engineers cut three half plates out of the vessel's inshore broadside, just below the between deck beams in each hold, and were just enabled to finish this difficult task before the flowing tide rose up to the upper edge of these holes, as the lower cutting was executed first, to give as much time as possible in cutting them. They were cut from the outside of the vessel on stages, as it was impossible to do so from inside on account of the cargo.

Night now set in, so a tent was rigged on shore, and the ship's valuables, chronometers, &c., with the crew's effects, were safely landed; one engineer and two firemen were left on board to keep the engine-room free of water, with a lifeboat moored under the lee of the vessel, and all hands being tolerably exhausted, stole a few hours rest till daybreak.

Poor Captain Ben slept little, his mind was troubled too much, and at the first streak of dawn he wandered out on the lonely beach, and found it, according to his expectation, literally covered with coke as far as the eye could reach, the last tide having scoured it all through the holes the engineers had cut in the broadside of the vessel.

When all hands got on board they found no cargo remaining in the ship above the level of the lower edge of these holes, and just then a small tug was seen in the offing towing four large lighters piled sky high with empty oil casks, and a few short spars, proving the chief officer was well worthy of the confidence reposed in him by the master, and had faithfully done his duty.

When the small tug came alongside, Captain Ben made an agreement with her master for £20 to run his bower anchors out to seaward 120 fathoms, and to remain by the vessel at £20 per day till further orders, which contract was agreed to at once. The anchors and cables were accordingly run out to seaward, one cable being taken in aft, the other forward, hove dead taut, and securely made fast.

At low water the engineers bolted three stoke-hole plates, cut to the proper size, over the holes they had previously cut in the broadsides, cementing the same perfectly water-tight, inside and outside the vessel.

Stream chains were secured to the fore mast and passed under the keel both ways, port to starboard, and *vice versâ*, and their ends hung loosely on the bow of a lighter moored on each side of the ship in the wake of the fore rigging.

Other two lighters were placed with their bows abreast of the main rigging *(see Plate No. 136)*, and the ship's wire hawsers secured to the

mainmast, under the keel both ways, in the same manner as forward, then passed loosely over the bows of the lighter. The reason why wire hawsers were taken for this duty aft was, no other gear on board was strong enough to heave the lighters down, the cables being all in use, and as the B. had only 60 fathoms of stream chain, that was fully employed lashing the two forward lighters down.

During the day the engineers managed to get two hand pumps down the No. 2 hold, and connect them on the ends of the No. 2 deck winch, and famously they worked. By this means, and the other pumping power at command, it was concluded by the engineers that with ease they could keep the water down in No. 2 compartment, as long as the bulkhead leaked no more than it had been doing previously.

This was good news for Captain Ben, as he had enough oil casks to fill up the remaining space left by the jettisoned cargo in the No. 1 and after hold chock up to the upper deck, for now there would be no necessity to place casks in No. 2 hold. And that hold itself, with the engine and boiler room space, free of water, was sufficient to float the vessel on a pinch.

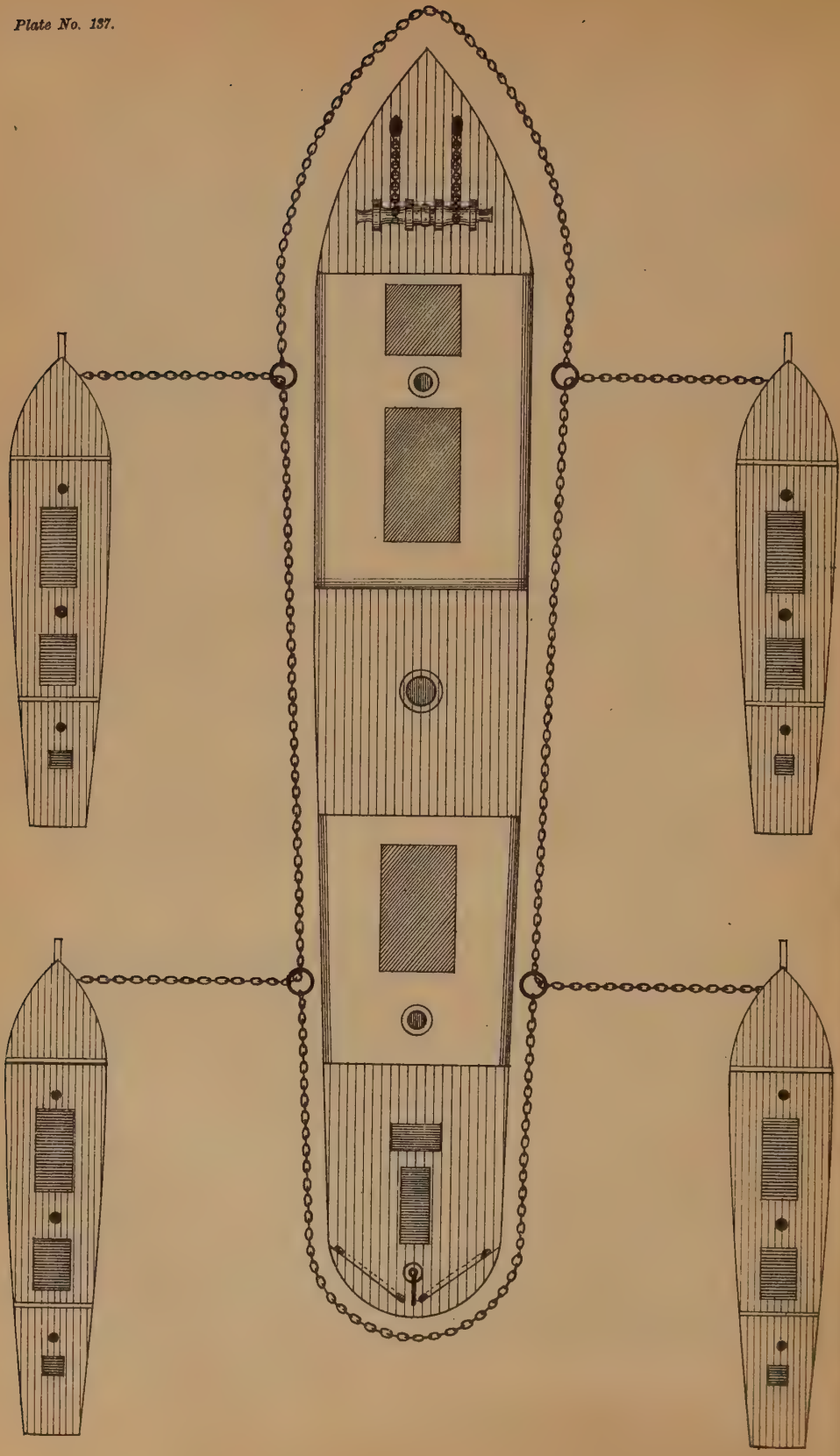
Willing hands now shored strongly up the No. 1 bulkhead in No. 2 hold, as far down as the top of the cargo, and also got a couple of good shores on the after bulkhead down in the engine-room.

The flowing tide now set in, and as a capital day's work had been done, the small tug conveyed all hands ashore with the exception of an engineer and three firemen, who were left on board as before to tend the steam pumps, with orders if anything went wrong to send up a rocket immediately.

Captain Ben and his trusty crew now snatched a few hours' rest, to be able to present a good front on the morrow, and the fishermen were ordered to be on the beach at dawn, all ready to go on board. At 5 A.M. next morning, two hours after high water, all hands got on board the B., when Captain Ben was informed by the second engineer, whose countenance beamed with delight, that they had got the No. 2 hold nearly dry, and that the bulkhead shores were standing famously.

Captain Ben then mustered all hands, and the fishermen, and told them it all depended on their smartness of stowing the casks in the No. 1 and after-hold *if the ship came off that day or not*, and he added, if *she did*, and the casks were stowed in time, he would make the fishermen a present of £50 amongst them. This harangue was hailed with a cheer, and jackets began to fly off, and strong, brawny arms to appear naked to the shoulder. That, Captain Ben knew full well, meant good-will and great determination to succeed, and it made his heart feel lighter than it had for many hours.

*Plate No. 137.*



When the ebb-tide was far enough down for the upper part of the cargo of coke to show itself, a perfect furore ensued, casks were flying out of the lighters into the No. 1 and after holds, in all directions, and burly, willing hands were stowing them tier on tier in the holds like magic.

Whilst the fishermen were thus busily employed, captain, officers, and crew were ballasting the lighters at their after ends with spare fire bars, kedge anchors, derrick spans, &c.; and shortly after low water all the casks were in the holds, the decks being protected from the strain by planks laid along under the deck beams, the casks being chocked up to these planks, and the hatches secured. Strong spars were then lashed over the tops of the hatches and coamings *(see Plate No. 137)*, and the lighters hove taut down by the sling chains.

At half-flood, just as Captain Ben was thinking about slacking up the lighters, as they were down to their bow-rails in the water, the good B. sallied a little, and up she came three feet, the slackened cables proving she had drawn off the bottom. All the steam pumping power the engines could exert had been for some time lashing all the water they could throw out of the No. 1 and after holds. All hands now clapped on the luff tackle falls, aided by the steam winches on the cable chains, and drew the vessel off some 100 feet into deep water.

Captain Ben then ordered the small tug to take in the vessel's tow-line from forward, and when this was done he slipped the bow cable and held on the stern cable. After the tug had pulled the vessel's head seaward, the stern cable was slipped (both cables had been previously buoyed), and the engines turned easy ahead, and under the guidance of a good local pilot the steamer B. was landed in a well sheltered cove, some two miles from the scene of the disaster, on a good shelving, sandy beach.

Next day other four lighters were lashed down to the vessel at low water, to assist the first four when the empty casks were taken away, and every tide the ship was fleeted further up the beach till she dried at low water, and then the remaining part of the cargo was safely landed.

When all the cargo was out (the lighters being still kept lashed down to the vessel) Captain Ben ordered the crew to give the ship a strong list to seaward, (as she was broadside on to the beach) whilst she was afloat near high water time, by placing all the movables about the deck on her off-side, and filling the boats with water, so that when she took the ground on the ebb tide it left plenty of room under her flat at low water to get at the damaged plates. Accordingly, at low water several

holes, large and small, were found under her flat in the No. 1 and after hold. The small holes were quickly stopped by Wood's leak stoppers, a couple of sets being always on board of the B.; the large holes were stopped by bolting over them pieces of a few spare plates taken out of the engineer's storeroom, and a large hole eight feet by two in No. 1 hold was secured and made perfectly tight by bolting over it two planks, 3 inches thick and 15 inches broad. They were well caulked outside, and cemented properly inside.

The lighters were still kept hove down to the vessel, and when the above named work was finished Captain Ben hove the ship off the beach a little, and turned her round, trimmed her over the other way, and landed her again upon the beach, serving the starboard side in the same manner as he had the port, although it was found the greatest amount of damage was on the first side repaired, viz., the port side.

The lighters were now cast adrift and removed, the ship hove off the beach and safely anchored, as the fishermen, during the time the B. was on the beach, had recovered her anchors and cables, and brought them alongside.

Whilst the vessel was getting patched up, Captain Ben had entered into an agreement with an agent, pending further instructions at home, to take charge of the remaining part of the cargo. And he, the agent, well knowing the high standing and respectability of the owner of the B., had advanced Captain Ben sufficient cash for his disbursements.

Captain Ben then sent home the following telegram:—"Afloat, temporary repairs, cargo agent's hands, third saved; expenses incurred £500; proceed to-morrow Bermuda—letter follows."

As poor Ben steamed out of the sheltered bay as old Sol was just popping over the mountains, he concluded he had succeeded in pulling through a pretty tough job very fairly, or as well as could be expected, considering his vessel was sunk on a coast where no assistance in ship lifting was procurable with the exception of a few old lighters; for had he been near a port where the resources of a ship-building plant was at his disposal, or where he could have obtained half a dozen centrifugals, or pulsometers, not to speak of a set of Gwynn's steam pumps, or 3 or 4 Thames Conservancy ship-lifting craft, with their splendid outfit of slings, the steamer B. would have been an easy job to lift to what he found it, with all his makeshift gear.

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On January 1st, at midnight, near the port of Ferrol, the S.S. *Crux*, 1,000 tons register, Captain Coll, after colliding with a large foreign steamer, sank in 50 feet of water, all hands saved. At the time the accident occurred the *Crux* was bound to Lisbon in ballast.

Such was the gist of a cablegram duly posted up in the Royal Exchange, London, on January 2nd.

As this sunken vessel was afterwards successfully raised, we will try and describe in detail the means employed on the occasion.

Immediately after the vessel sank, Captain Coll ordered a diver to go down and minutely examine her bottom, and the following was the diver's report.

The *Crux* lies on a soft, muddy bottom, her keel being embedded to the extent of three feet; No. 2 hold is cut down on the port side from deck to bilge, also a plate in the after hold is damaged and started.

The damage in the after hold occurred through the vessel touching a rock after the collision, a few moments before she finally sunk.

After carefully considering over the diver's report and the vessel's surroundings for a couple of hours, Captain Coll wired home to his owners, telling them the position of the ship and her surroundings, and adding no proper salvage appliances were available at the port, but that he could procure the necessary gear to lift the vessel himself, if he had permission to do so from the underwriters.

If that permission were granted, he thought it quite possible to lift and place the *Crux* safely upon the beach in a week's time, and then patch her up temporarily, preparatory to docking the vessel.

Captain Coll had a share in the ship himself, and he well knew she was only insured for half her value. I may also add, she was nearly a new vessel.

Next day the Captain received an answer to his telegram telling him to get to work on the vessel as soon as possible, and guaranteeing the expenses.

By this time Captain Coll had matured all his plans for lifting the ship, and had sketched them all roughly out on paper; so he called all his officers and engineers together, laid before them his plans, and described all his proposed operations in detail minutely, and asked them for their joint co-operation in carrying out the work to save the vessel, adding that he had no doubt but that their labour would be handsomely rewarded hereafter, if they succeeded in lifting the ship.

The chief engineer was a man of great energy and resource, so Captain Coll well knew he had a splendid right-hand man to assist him in the undertaking, and this was somewhat of a consolation in itself to the Captain.

Four large hulks were engaged at five pounds per day each; two were moored right above the *Crux*, abreast of her foremast, one on each

side, and the other two hulks the same way aft, abreast of her mainmast. These hulks were moored head and stern, to prevent them swinging foul of each other, or fouling the topmasts of the *Crux* that were well above water.

One of the hulks was provisioned, so that the captain, officers and crew could live on board and save the unnecessary time and trouble of pulling to and from the shore.

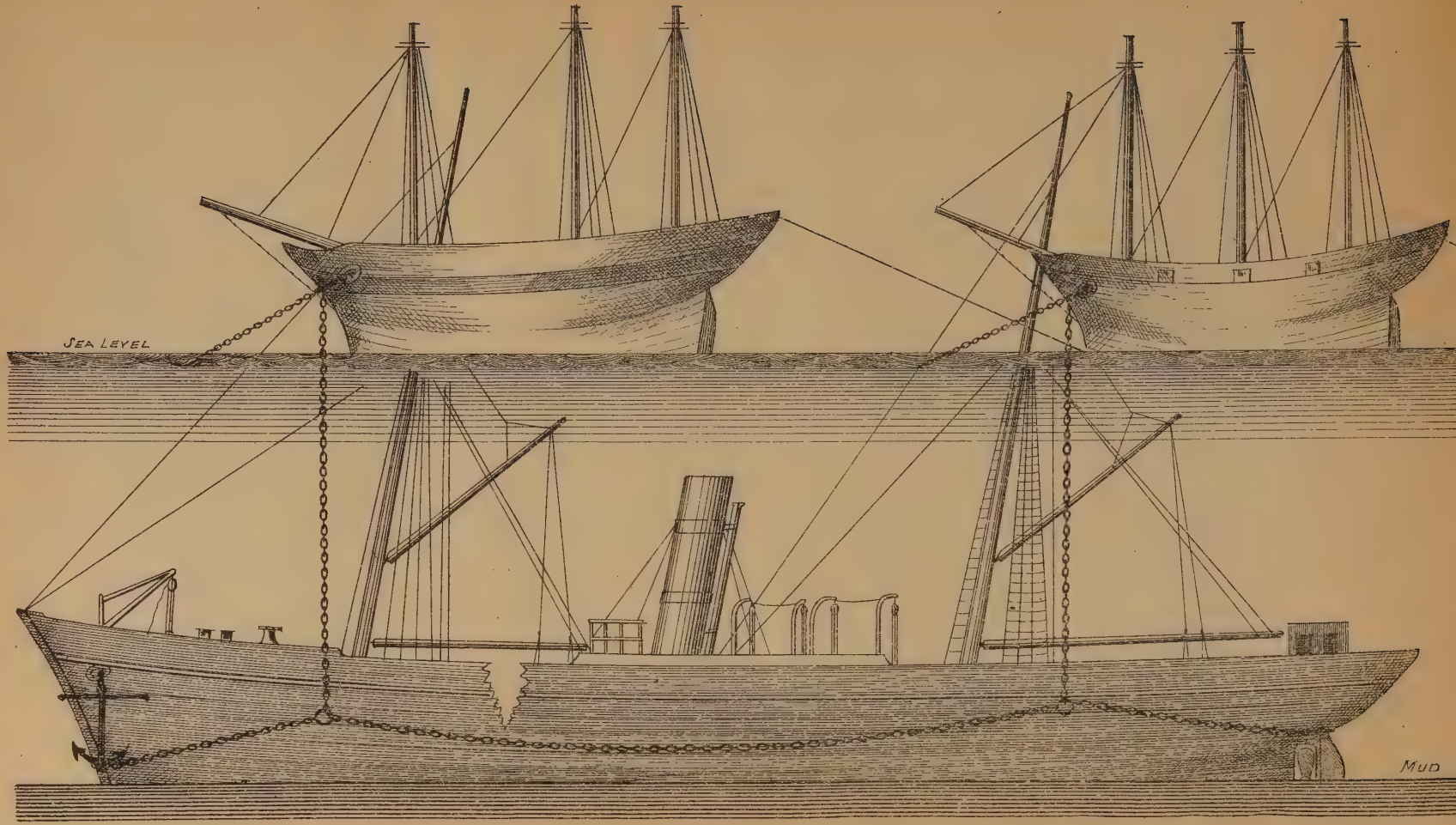
Through the kindness and condescension of the Admiral Superintendent of the Naval Dockyard, Captain Coll was allowed the use of a couple of sets of centrifugal pumps, two large 2½-inch cable chains, 120 fathoms in length each, four large mooring rings 16 inches diameter, and a few hawsers and lines, &c. And the good Admiral whipped the whole lot of the gear into a government tug, and sent them alongside of one of the hulks moored to the wreck of the *Crux*.

Two 20-fathom lengths of the cables were then taken, and a large mooring ring shackled on each end *(see Plate No. 138)*. These bridles, as we will call them, were to lay round the bow and stern of the *Crux*.

Two small 40-feet lighters were then moored about 20 feet ahead and astern of the *Crux*, at right angles to the fore and aft line of the ship. The cables were now placed on board of a large lighter, which was properly fitted with rope stoppers, to enable the cables to be eased down on the bottom handsomely.

One end of the cable was now made fast to the small lighter at the bow of the *Crux*, and the bight eased down on the ground. Then the large lighter was hauled along the side of the steamer till she came alongside of the small lighter moored athwart the *Crux's* stern, the cable being eased away with the stoppers as the lighter passed aft. The remaining end of the cable was now passed on board of the small lighter, moored athwart the steamer's stern, and temporarily made fast. The large lighter, with the remaining cable on board, now hauled forward of the *Crux* on her opposite bow, and laid the cable on the vessel's opposite side, as just described. Therefore, both cables now lay on the ground along the sides of the steamer, with their respective ends fast on board the two 'thwartship lighters.

The bridles, with the large mooring rings attached, were now placed on board of each of the 'thwartship lighters, and each cable end was rove through the mooring rings; the bridles were then slipped, and let run down the cables on to the ground, ahead and astern of the steamer. The diver was now sent down to middle the bridles round the stem and stern-post of the steamer, and arrange the slings in their


SEA LEVEL
MUD

proper places, the crew tending the cables as required, until they were placed to the satisfaction of both Captain Coll and the diver. (*See Plate No. 136*, showing two views—one how the slings were passed, the other with the slings taut up ready to lift the vessel.)

Why the ship was slung in the manner just described was because she was so far mud warped, it was impossible to pass slings under her bottom.*

After the slings were set moderately tight in their proper positions, each end of the cables was taken on board the four respective hulks, and passed through their bow hawse-pipes, and round their windlasses. While this work was being accomplished, four carpenters from the dockyard were shoring the windlasses and hawse-pipes of the hulks; and four gangs of shore labourers were employed trimming the hulks eight feet by their sterns, as Captain Coll was well aware that the first lift would be a heavy one to start the vessel out of her mud bed.

To complete these operations it took three long summer days' work from sunrise to sunset, as the captain gave his men a rest on the night tides, so that each man would come fresh and strong to his duty each morning, and fully capable of pulling through a hard day's work; for the captain was well aware they had a difficult task before them, and that it would require all the resolution and energy of both master, officers, and crew to bring it to a successful issue.

As it was impossible to get any craft lashed down to the vessel's midship section in her present position, to do any real service, without clapping the slings on to some of the ship's upper works, which might materially damage the vessel, Captain Coll determined to lift the *Crux* by her ends, but only high enough off the ground to enable the diver to pass a pair of slings under the midship section.

All being now ready to lift the ship, the hulks were hove taut down by the slings at first quarter flood, for, as mentioned above, a small lift was only required in height, although of great power, just to raise the vessel high enough to get the slings beneath her amidships. This day a hundred labourers were employed from the shore to man the windlasses on board the four hulks; the *Crux's* crew tending upon the diver and the sling chains. At three-quarters flood Captain Coll, with evident satisfaction, perceived the vessel begin to lift, each hulk being down nearly to her hawse-pipes. The diver was immediately sent down, and he rove a runner chain under the keel amidships, and

* With a straight-stemmed vessel the forward bridle might have slipped up; but in such a case an anchor stock entered out of each hawse hole would have been sufficient to hold it.

in half an hour's time a length of the 2½ cable was safely passed under the *Crux's* bottom, in the wake of the engine-room, right amidships of the vessel.

The ship was now allowed to sink down in her old bed, and all preparations were made for a good lift on the next daylight tide, the hulks being slacked well up for the night.

Before low water next day, two three-hundred ton lighters were brought alongside by the captain's orders, and made all ready for lashing down to the 'midship slings passed the day before, and a powerful tug engaged for the day.

On the last of the falling water all the four hulks and two lighters were hove down, and at dead low water the windlasses of the hulks were pawled, and the cables well bitted abaft of each of their windlasses. And at first quarter flood the vessel lifted, which was hailed by a good British cheer from all hands. As the tide lifted, the tug kept drawing both the *Crux* and hulks in-shore, and at the top of high water the vessel was landed a quarter of a mile nearer the beach than where she sank.

At low water the ship was found to be in 40 feet of water; this concluded the fourth day's work. On the fifth day at low water the craft were all again hove down by their respective slings; the ship lifted and carried considerably nearer the shore, at low water there being 28 feet around the ship. On the sixth day the ship was again lifted and carried further in-shore, and at low water her upper deck dried. Just before she took the ground a heavy pair of slings were passed underneath the *Crux's* bottom, abreast of the foremast. (The reason these slings were passed was to enable the two after-hulks to be dispensed with, if the pumping power that was about to be placed down the after hold was found sufficient to overcome the influx of water. The after-lifting power of the hulks being dispensed with, would cause the sling cables and bridles to all come adrift; so it was compulsory to pass another pair of slings under the ship to lift her forward end, as the damage in the No. 2 hold was of so serious a nature that pumps were of no service, and no alternative remained but to bodily lift the vessel forward with craft up the beach till she dried at low water, and then the damage could be temporarily repaired.

At low water all hands were employed getting the two centrifugal pumps out of the hulk, and lashing them with their attendant boilers, &c., securely on the raised after deck of the *Crux*, with small winch chains, to prevent them getting unshipped when the night tide overflowed the vessel.

As soon as ever the pumps were in position, and the suction pipes fitted together down the after hold, the fires were lit, and as soon as steam was up, the centrifugals were set away full bore. After they had been running nearly an hour, the chief engineer reported to Captain Coll that they were gaining rapidly on the leak. It was now evident that the pumping power was quite sufficient to keep the after hold free of water, and float the after end of the vessel, provided no water found its way into the hold down the hatchways; so the pumps were stopped, and the fires drawn for the night.

The bridle slings were now let go on board of all four hulks, and dropped on the bottom, as they were of no service in lifting the vessel when the two after hulks were removed; which latter named hulks were now taken away and moored in the offing.

The two forward hulks now took in the slings previously passed under the bottom of the *Crux*, abreast of her foremast, and steadied them moderately tight, allowing for the rise of the night tide, and made all ready to heave down again the next day tide.

On the next falling tide, when the upper deck began to dry, the boilers belonging to the pumping engines were set away as quickly as possible; and at dead low water the two forward hulks, also the two 'midship lighters, were hove taut down to their sling chains.

On the seventh day, at first quarter flood, the *Crux* was again floated, the chief engineer reporting at the time, with a smile on his honest face, that there was only five feet of water in the after hold, and seven-and-a-half feet in the engine-room, and that the pumps were overcoming the water very fast.

At the top of high water the ship was landed as high up the beach as possible, and, as Captain Coll expected, next low water the vessel dried.

In two days' time the rent in the No. 2 hold was planked over, caulked outside, well cemented inside, and securely shored. The leak also was repaired in the after hold, and on the tenth day after commencing the lifting operations the *Crux* was hove off the beach, and safely anchored in Ferrol Harbour, awaiting her turn to go into graving dock to be thoroughly repaired.

Captain Coll considered things had turned out as well as could be expected under the circumstances, and as he walked up over a rocky road with a light heart and joyous tread, he thought every now and then he could hear the soft westerly winds sighing through the mountain gorges, whispering the words:—

We're rough, but we're ready,
Steady boys, steady,
We've fought and we've conquered once more.

As he was handing in his telegram to the clerk, a buyer of old wrecks passed him a nod of recognition, but a smile lit up for a moment the honest skipper's weather-beaten countenance, as he muttered to himself the words, "Yes, old boy, it's all right, but you won't get the wreck of the *Crux* to dissect this voyage, at any rate."

Captain Coll's telegram ran thus:—"*Crux* afloat, leaks stopped, dock to-morrow, expenses lifting £667."

For the benefit of our readers we append a copy of Captain Coll's bill, as we consider it a very moderate one.

EXPENSES INCURRED.

| | £ | s. | d. |
|---|---|---|---|
| Loan of 4 hulks and 3 lighters ... ... ... | 200 | 0 | 0 |
| Diver £50; tug steamer £50 ... ... ... | 100 | 0 | 0 |
| Repairing leaks, cement, planks, bolts, &c. ... ... | 61 | 0 | 0 |
| Gratuities to divers persons ... ... ... | 49 | 0 | 0 |
| Shore labourers bill ... ... ... ... | 112 | 0 | 0 |
| Provisions for officers and crew ... ... ... | 45 | 0 | 0 |
| Loan of the Admiral's dockyard gear ... ... | 100 | 0 | 0 |
| Total ... ... | £667 | 0 | 0 |

P.S.—This £667 saved a vessel worth £30,000, so no one grumbled in old England at the outlay.

## CONCLUDING REMARKS.

If a sunken vessel lies on a sandy or mud bottom, try if possible to get slings passed underneath her, on the FIRST LOW WATER after the accident; for remember, every tide she will work further and further into the mud or sand, rendering it eventually very difficult to sling her, if not impossible, without lifting the ship by other means.

Say she is well sand-warped, then act thus: Pass a powerful pair of chain slings, well parcelled with old bagging (to prevent them injuring the ship), under the vessel's quarters, close up to the rudder trunk, and guy them moderately tight forward to the deck quarter-pipes, so as to prevent the slings slipping aft, but not to have too much strain on these guys whilst lifting the vessel. You are now going to make *a miller's lift* upon the vessel—namely, raise one end of her.

Lash down the lifting craft, and raise the vessel off the ground aft just high enough to pass slings underneath her keel, and carry them forward to the positions required; then lower the vessel down on the ground on the falling tide, and sling the lifting craft as necessary.

Powerful FLAT steel ropes are now mostly used by ship-lifters, on account of their not injuring the vessel; also, if by undue strain they are carried away, no one is likely to be hurt working near them; whereas if a heavy lifting cable carries away under great strain, the broken links are apt to fly about. and have often been the cause of sad accidents occurring.

Vessels sunk in positions where their upper deck dries between high water and half ebb can often be lifted by securing their deck openings, fore and aft, with planks well caulked, or temporarily raising their combings with wood erections sufficiently high to prevent high water overflowing them, and then pumping them out. If the damage to the hull is such that it can be overcome by pumping power, this can easily be ascertained by an experienced ship-lifter by having two guages properly fitted, one inside, the other outside the vessel properly marked, and watching the rise of water on the flowing tide inside and outside the ship. But this will all depend on the nature of the leaks, and the ship-lifter will soon determine whether he can pump the vessel out or not; and if such is not practicable, then, of course, he will have to sling the vessel, and lift her with craft.

Vessels when sunk on soft sand or muddy bottom are very difficult to start out of their bed, especially so if let remain immersed for any length of time. This difficulty is caused by a vacuum forming under their bottoms; if such is the case, the vacuum can easily be broken by placing a couple of inch pipes under the ship's bilges, and forcing a stream of water under good pressure down the pipes; or a small stream of water forced down through the ash cock, or, in fact, any hole in the ship's bottom, will quickly destroy the vacuum.

A walk down to a wharf surrounded by mud will soon enlighten any person as to the great power this vacuum has in keeping a vessel down. Schooners discharging heavy cargoes at Dudman's Wharf, near London, have at times been overflowed, before the vessel would lift on a rising tide, and sunk. It is often necessary for the crews of these vessels to go aloft at half flood and shake the masts, thereby disturbing the hull in the mud, which breaks the vacuum, and the vessel jumps up in a second 2 or 3 feet. Many vessels constantly trading to such places keep a small chain round their bottom whilst at the wharf, and at tide time, when the vessel is about floating, this chain is hauled up and down, which operation destroys the vacuum, and the ship rises as the tide flows.*

This vacuum must be carefully considered in ship-lifting, for in

* This mud suction was commented on in the case of prosecution of *S.S. Foyle* in the upper reaches of the Mersey, Nov. 1891.

some localities, with a large sunken vessel, if it was not attended to, the largest pair of slings you could pass under her would probably give way before the ship would lift.

Heavy leaks in ships' bottoms are effectually stopped very simply by the Stockholm Neptune Salvage crews, and as their *modus operandi* might some day come in very handy to a shipmaster in some outlandish place, we think it well to place the same before our readers.

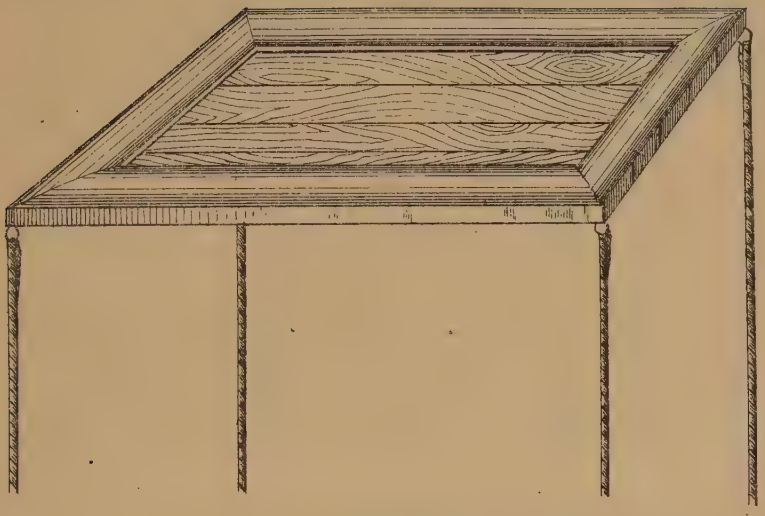
If the ship is hard on the ground she is listed, if possible; large wood doors, generally speaking seven feet by four, are formed of 2-inch planks securely battened at the back, water-tight, an eye-bolt being screwed into each corner, and in these eye-bolts are spliced four guide lines. Round the edges of these doors a canvas bag is nailed, well stuffed with sea-weed, about 12 inches broad and 4 inches thick. The door is then weighted, to make it sinkable, and two of the guide lines passed underneath the ship's keel and up the side on deck just in the wake of the leak, the door being lowered away by two guide ropes on one side of the ship; whilst hands on the other side are hauling away on the other guide ropes, and place the door right over the leak with the assistance of the diver. When the door is in the required position, with the guide ropes all taut hauled up, several parts of a winch purchase chain are taken right round the ship underneath her keel, and set well taut over the door; this binds the door hard up against the bottom, and stops the leak. Then the salvage steamer places her suction hose down the sunken vessel's holds, sets away the pumps, and lifts the vessel. *(Plate No. 139.)*

I may add that if these doors have to be placed near the keel of a ship, it will be necessary to bolt chocks on the doors of greater depth than a sunken vessel's keel, so that the strain on the purchase chain will come on the door chocks much harder than it will on the keel, and will cause the door to be bound hard up against the ship's bottom. When the steam pumps are in full swing inside the vessel, and the external water pressure outside acting upon these doors, they become glued to the iron, and have often to be broken all to pieces before they can be removed.

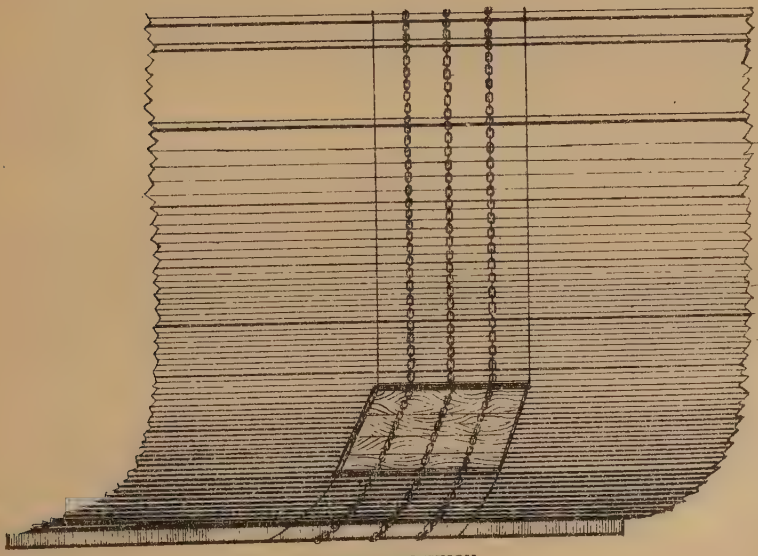
The writer, some years ago, stood under the bottom of a vessel called the "Edith Hough," of Liverpool, in a graving dock at Stockholm, when 6 or 8 of such doors as described above had to be torn all to pieces with crowbars before they could be removed from her bottom.

Whenever possible, when raising a sunken steamer the boilers should be pumped out, as also the shaft tunnel and recesses, and, if it can be done, the compartment before the collision bulkhead. If all these can be turned into air chambers they will be of considerable assistance.

*Plate No. 139.*



PADDED DOOR.



DOOR IN POSITION.

As I have before remarked, ship-raising has become quite a science at the present day, and I think all will own who engage in such work that it is no small hydra to conquer successfully, hardly any two cases being cured by the same treatment. And further, the writer knows of no trade or profession which requires more forethought, resolution, skill, and energy in surmounting difficulties.

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## SECTION XLV.

# HEAVING DOWN.

Vessels at times receive damage to their bottoms at places where no slip-ways or graving docks are available, therefore it behoves every seaman to know what to do, and which way to do it, when such an emergency arises.

Vessels are much easier hove down to floating craft than they are to the shore, especially so where there is a great rise and fall of tide; for in places where a great rise and fall takes place, the heaving down tackles have to be constantly attended to if heaving down to the shore; whereas if the vessel is hove down to craft afloat, once they are hove down no further attention is necessary to the purchase falls.

If a large vessel has to be hove down, a suitable spot must be found, out of the way of a strong tide, the stiller the water the better; she must then be moored fore and aft with anchors and cables. If the damage is on her starboard side, two suitable laden lighters must be moored abreast of her main and fore-mast on her port side, about 20 yards from the vessel, and powerful chain strops well parcelled passed underneath their bottoms, and brought up above their deck to secure the lower purchase blocks to in heaving down.

Commence and send down all yards fore and aft, also the topgallant masts; but it is not necessary to send down the topmasts if you do not wish to do so, although they are better down out of the way if you have plenty of time at your disposal.

Having made everything snug aloft, slack up the lanyards of the port fore and main rigging, and knock out the wedges in the partners; then stay the masts by the starboard rigging hard over against the starboard partners, and secure the lanyards; then set the port rigging up moderately tight and make it fast. If you are anyway

doubtful of the strength of the lower rigging, a couple of bights of a good steel hawser may be passed under the ship's bottom abreast of the lower masts, and set up to the masthead with a couple of good luff tackles.

Next take either the fore and main yards, or a couple of topmasts if they are long enough, and place their heels on good beds close up to the port water-ways abreast of the two lowermasts, and lash their upper ends securely with a stout cross lashing to the lowermast heads below the trestle-trees; then cleat the lashings well, to prevent them slipping *(see Plate No. 140)*, and shore up the main deck below their heels.

Two heavy four-fold blocks must now be securely lashed to the lowermast heads, capable of reeving a good hawser of steel or hemp, and corresponding blocks must be hooked on to the heaving down strops already alluded to in the lighters moored alongside the vessel.

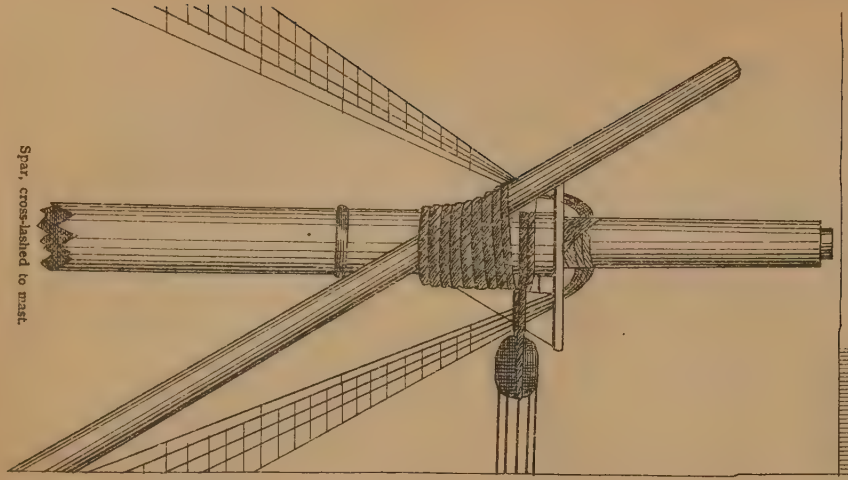
Then reeve both tackles full, and steady them tight. Mind as little ballast as is actually necessary should be in the ship, and what ballast there remains in her must be shored down, below planks, from the hold beams; but it as well to remark that ballast, during heaving down a vessel, is detrimental to the operation in many ways—meaning, of course, more than is actually necessary to make her stand upon her legs—as the greatest difficultv exists in securing it from tumbling all over on one side when the vessel is hove down, which, if it did, would prevent the vessel righting herself when the purchases were slacked up, after effecting the necessary repairs.

If plenty of water casks or small tanks are available, they constitute the best ballast, as they are easily secured to large spars lashed in the holds, when stones or sand would be very difficult to secure properly.

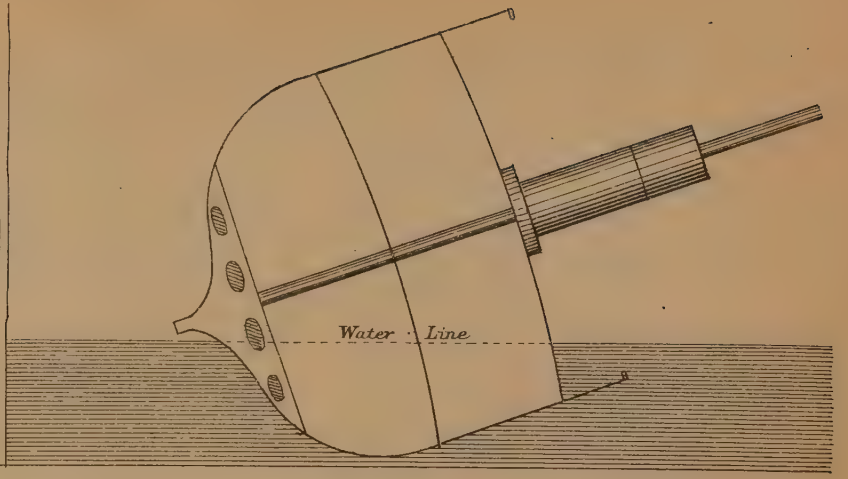
A couple of wooden pumps, if iron ones are not procurable, must be temporarily fitted down the hatchways, to pump out the holds if the vessel's upper works are leaky; and every movable thing about the ship must be well lashed and secured before commencing to heave down.

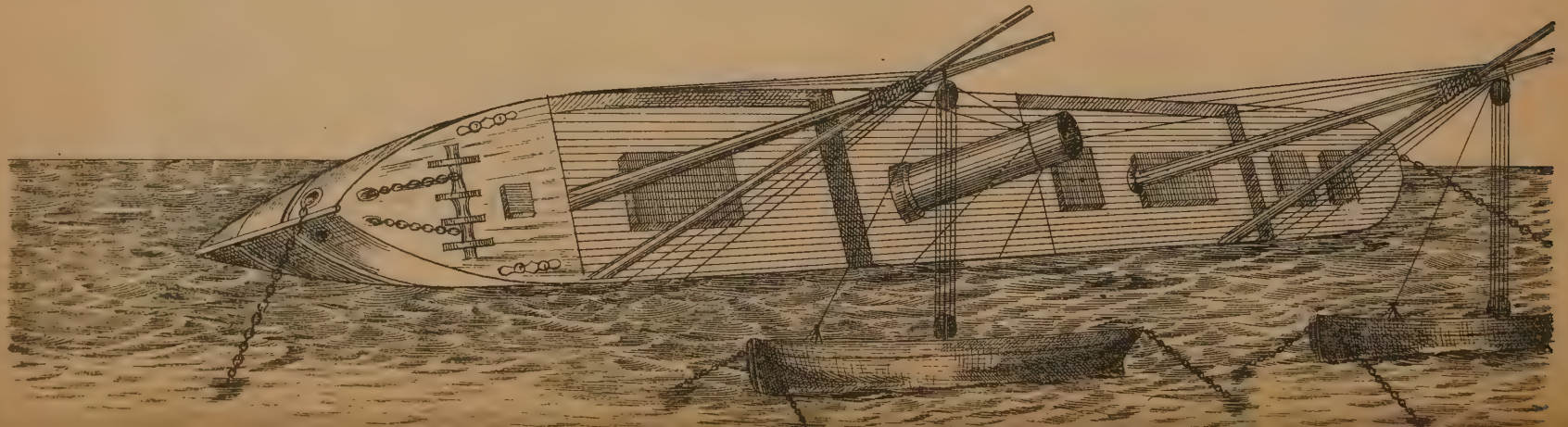
When all is ready, take the purchase falls to the lighters' windlasses and heave down; if there is any tide at the locality, wait till slack water and then heave her down. Mind and heave most of the weight on the purchase fall connected to the mainmast, only take in the slack of the fore one to assist the main one; as the mainmast, being in the centre of the ship, is supposed to be the heaving down lever, the fore one merely acting as a preventer in case of accident. Before the slack of the falls are in, the ship will begin to cant; as she comes over, slack up the lighters' moorings, and let them plumb themselves. When the vessel is down far enough, rack the falls and belay them.

*Plate No. 140.*



Spar, cross-lashed to mast.



Great care is absolutely necessary in easing the vessel upright; see that the falls are eased away handsomely, and not surged with jerks.

Vessels are often coppered at the present time in this manner in several ports in Sweden and France, the writer having seen many vessels coppered throughout in St. Nazaire dock in this manner, merely to save the expense of docking the vessels. East Indiamen up to 700 and 800 tons register are commonly caulked and coppered in this way at the above-mentioned seaport, where docking is more expensive than it is in the United Kingdom.

Steamers at foreign outlying places, where there are no graving docks, might, in the writer's estimation, be repaired in the same manner, as the disposal of their water ballast would considerably facilitate such an operation.

In such a case the machinery would have to be well shored, also the boiler, to prevent it getting unseated, and the funnel extra well guyed. But if this were properly done, there is no reason why a steamer could not be hove down just as easily as a ship.

In repairing ships that are hove down, floating stages are of great service, as they enable the workmen to get down to the water's edge without trouble. All openings in the side, such as cabin dead-lights and ventilators, and any other holes there may be situated close to the waterways on the side of the vessel to be hove down, should be carefully looked to before heaving down, and securely fastened up water-tight. If these directions are attended to, a seaman will find no difficulty in heaving down his vessel.

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## SECTION XLVI.

## DISPLACEMENT, &c.

Some years ago, when a large passenger steamer was sunk in harbour by being left in the charge of a coal gang at night, without any supervision by the ship's officers, under which circumstances she was listed over till the water came into her lee coal ports, and she filled and foundered, a great cry was raised that shipmasters knew little or nothing about "curves of stability," though what this had to do with the accident in question remains a mystery to the practical seaman. By degrees, however, it dawned on the minds of most thinking men that naval architects, who were engaged in draughting merchant vessels, were scarcely well informed on the matter, and gra-

dually the outcry against the poor shipmaster subsided. The discussion, however, bore good fruit by turning the attention of ship-builders to the matter, with a consequence that vessels are now built with better dimensions for stability than they were a few years back.

There has been so much talk of these matters since then, that it seems a necessary part of a modern seaman's education—especially as vessels are now laden to the extreme limit of safety—to know something about them; and an attempt is therefore made here to give the young seaman some idea of the meaning of the terms in ordinary use with regard to the subject in question.

*Displacement.*—When a ship floats in water she displaces as much water as is equal in size and form to the part of her hull which is below the water-line; the bulk of this water so displaced is equal in weight to the weight of the whole vessel and cargo at the time. Therefore, the solid measure of the part of the vessel under water will give the amount or magnitude of the water displaced, and the weight of that water will equal the weight of the ship as she lies with the cargo that may be in her.

A cubic foot of sea water weighs 64·11 lbs. Suppose it were possible to weight a box measuring outside exactly one cubic foot, so that it would float with its upper surface exactly level with the water level; we should then know that the weight of the box and load was 64·11 lbs.

Therefore, if the part of a ship below the water-line can be exactly measured in cubic feet, the number of such cubic feet multiplied by 64·11 will give the weight of ship and cargo in pounds.

The term "Reserve of Buoyancy" is a phrase employed to express the volume (and the presumed corresponding buoyancy) of the part of the vessel *not* immersed, *and which can be made water-tight.*

Return to the floating box once more. Suppose it had only $\frac{3}{4}$ of itself immersed, and $\frac{1}{4}$ above the water, the $\frac{1}{4}$ would be its "Reserve of Buoyancy." If more weight was put into the box it would float deeper and deeper till at last there would be more weight than it could float with; *all* its "Reserve of Buoyancy" would be gone, and it would sink.

So we have—Immersed part of ship = Buoyancy.
Out of water part = Reserve of Buoyancy.

The sum of the two *is presumed* to express the total floating power of the vessel.

The general opinion seems to be that the minimum of reserve buoyancy should be about 20 per cent.; the principal point at issue amongst experts as to the method of allowing this quantity in loading vessels being, whether forecastles, poops, bridge-houses, &c., should be taken into account or not.

*Stability*, or *statical stability*, is best explained as the force a vessel exerts to return to an upright position when held over at a heel by any force, such as a beam wind. Suppose a vessel with a heavy weight of pig lead ballast stowed right in the bottom of her, fore and aft, and an empty hold above; every seaman knows that a vessel so laden would be excessively "stiff," and that if hove down on her broadside by a rope, would exert great power in attempting to return to an upright position; and if the rope were let go, she would swing back violently. Such a vessel is said to have great "stability," and this is the meaning of the term. It can thus be easily seen that a vessel can be so laden as to have far too much "stability."

Suppose, however, the same vessel had great depth, and was laden *full* with a cargo of light grain. It will now be seen that another condition of affairs takes place, and that she may very possibly not have enough "stability."

*Metacentre and metacentric height.*—A ship afloat may be imagined to concentrate her whole weight at the centre of gravity, and press *downwards* at that point.

The pressure of the water which buoys her up may in like manner be supposed to press *upwards* in an opposite way. *(Plate No. 141.)*

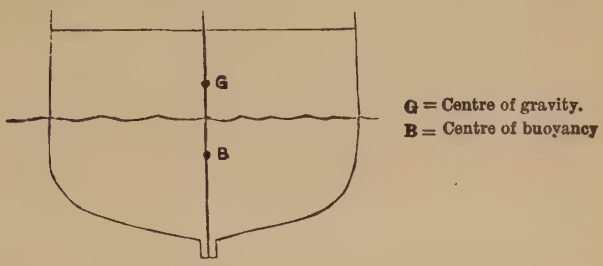



*Plate No. 141.*

When the ship is upright, these two forces may be said to act in a vertical line.

When the vessel heels from any outside cause, these forces not being in line, do not balance each other, but form what in scientific language is called "a mechanical couple."

If the force heeling the vessel be removed, she will change her trim till the centre of buoyancy is again in the same vertical line as the centre of gravity.

In stability calculations it is usual to assume that the position of the centre of gravity is known, and to calculate the place of the

centre of buoyancy for the displacement corresponding to any different positions of the vessel. These two data being known, the value of *G Z* in the diagram can be calculated. When the vessel floats upright at rest this will be nothing. *(Plate No. 142.)*

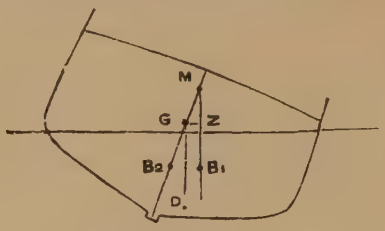



*Plate No. 142.*

Under the circumstances of a vessel *trimmed upright*, but heeled by any external force, the total weight of the vessel in tons multiplied by the value of *G Z* gives the amount of effort the ship exerts to recover herself.

[The approximate position (or depth) of *B* below the water-line is from $\frac{2}{5}$ to $\frac{9}{20}$ of the mean draught. The larger co-efficient should be used for ships of full form. If the draught is increased by an unusually deep keel, *B* will lie higher.]

Metacentre (*M* in diagram) is the intersection of the line on which the buoyancy exerts its force when the ship is inclined (*B* 1); with the line of its action when the ship is upright (*B* 2).

NOTE.—A scientific friend has given me this short method of obtaining the metacentric height.

Move a weight of 5 tons from the centre line towards the side till the vessel is inclined 3°.

Suppose the distance you have moved the weight is 14 ft. 9 in.

And that the displacement scale gives for your mean draught at the time, 1005 tons.

$$\text{Then metacentric height in feet} = \frac{\text{weight in tons moved} \times \text{distance moved}}{\text{ship's displacement in tons} \times \text{tangent of the angle of inclination.}}$$

The tangent of 3° = ·0524.

$$\text{Then metacentric height} = \frac{5 \text{ tons} \times 14{\cdot}75 \text{ feet}}{1005 \text{ tons} \times {\cdot}0524.} = 1{\cdot}4 \text{ feet.}$$

Metacentric height is, therefore, 1·4 feet.

By always inclining the ship 3°, ·0524 will be a constant.

If the centre of gravity (*G*) lies below the metacentre, the ship tends to return towards the upright when heeled slightly. The distance *G M* is the metacentric height.

If the centre of gravity lies above the metacentre, she tends to move away from the upright when heeled, and is unstable.

If the centre of gravity coincides with the metacentre, the ship, if inclined slightly, will stay so.

If the height of the metacentre above the centre of gravity is doubled, the ship's stiffness is also doubled ; if halved, the stiffness is halved.

The metacentre, therefore, may be said to measure the height to which the centre of gravity of the vessel may be raised without making her unstable when upright.

So far as can be judged, it would appear that metacentric heights in laden cargo vessels frequently lie between 1½ feet and 3 feet, sometimes falling to 6 or 8 inches, at other times exceed 3 feet.

The inclining experiment, resorted to in these days, is for the purpose of finding the position of the centre of gravity, which position partly depends on the construction of the vessel, but more on the distribution of weight in loading. For this experiment it is required to know the positions of *B* and *M (Plate No. 143)*. The ship is then heeled, and the distance between the centre of gravity *G* 1, when ship was trimmed upright, and *G* 2, the centre of gravity when heeled, is found by a simple calculation. This distance being found, the distance of the centre of gravity below the known position of *M* can be obtained.

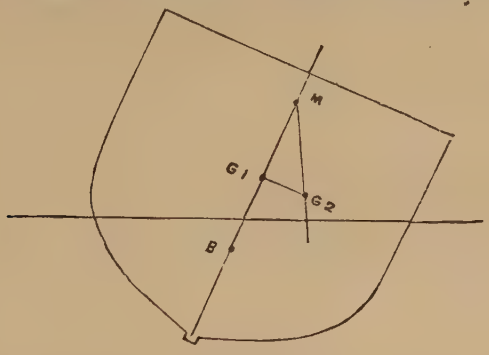



*Plate No. 143.*

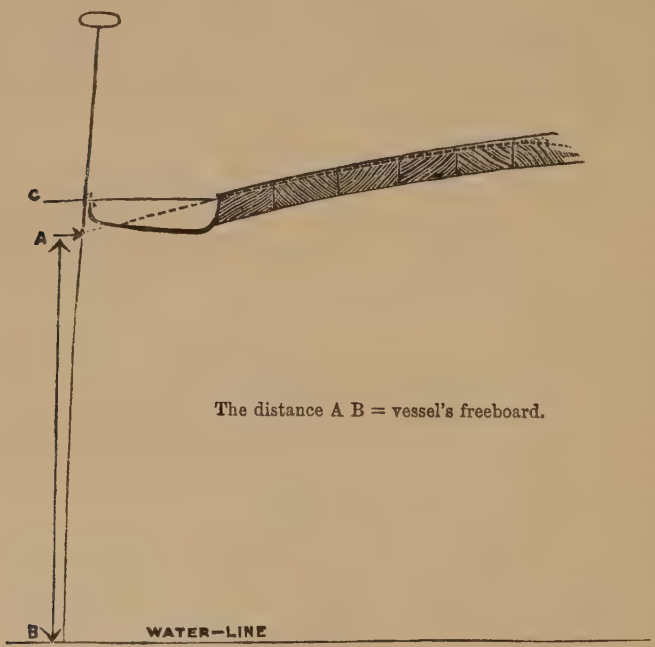
CURVES OF STABILITY.—To be able to calculate these requires more knowledge of the subject than most seamen possess, and in a book on seamanship a description of such calculations would be out of place ; but this much may be said. A new vessel is usually draughted by the builder to carry a certain amount of dead weight on a certain load-line. Now, if it is assumed that the ship is floating at this line filled with a homogeneous cargo (or, in plainer words, a cargo all of one kind), it is possible to get, with a fair degree of accuracy, the place of the centre of gravity, and also the amount of metacentric height. These data having been got, a curve of stability can be made by a draughtsman accustomed to the work, and will represent a condition quite as bad for the ship as she is ever likely to be in.

Cargo vessels, many of them, have stability left when on their beam ends.

So a simple calculation may be made for this extreme position; and if it is found that the vessel has righting power then, or only a small amount of instability, it is scarcely necessary to go into further calculations. This knowledge should be got from shipbuilders with every new vessel.

If the young seaman thinks necessary, he can pursue this subject further in text-books devoted to naval architecture; but it would appear to most people that it would be better for him to *first* make himself a *thorough practical seaman.*

FREEBOARD—is the vessel's clear side, at the middle of her length, on the water-line—from the point at which the camber of the deck continued cuts the side. *(Plate No. 144.)*




The distance A B = vessel's freeboard.

*Plate No. 144.*

The point at which a vessel's deck line is to be marked, according to the Act of Parliament, is on a line with the upper edge of the deck plank, next to the waterway. Thus the point for the deck line and for freeboard do not correspond. In ships with iron decks it is usual to allow the ordinary breadth of a waterway, and strike off a horizontal line from that point through the side, and the deck line is put on there.

## SECTION XLVII.

# ON CALCULATING FREEBOARD BY THE LOAD LINE COMMITTEE'S TABLES.*

NOTE.—Steamers under 80 tons register employed solely in the coasting trade must now be marked with an official load line.

On joining a strange ship the mate (and master) should see that their statutory freeboard marks correspond with their freeboard certificate. (*See the commencing paragraph of Explanation of Tables.*) In the accompanying sketch, *Plate No. 145* representing the section of a vessel at her deck line, *A* represents the point where the Act of Parliament says the deck line is to be marked—namely, on a level with the upper edge of the deck plank next to the waterway; but the freeboard tables start from a different point. The curve of the camber (or round of beam) of the deck is continued in an imaginary curve through the vessel's side, as shewn by the dotted line, and it is from the point where this curve comes out—namely, *B*—that free-

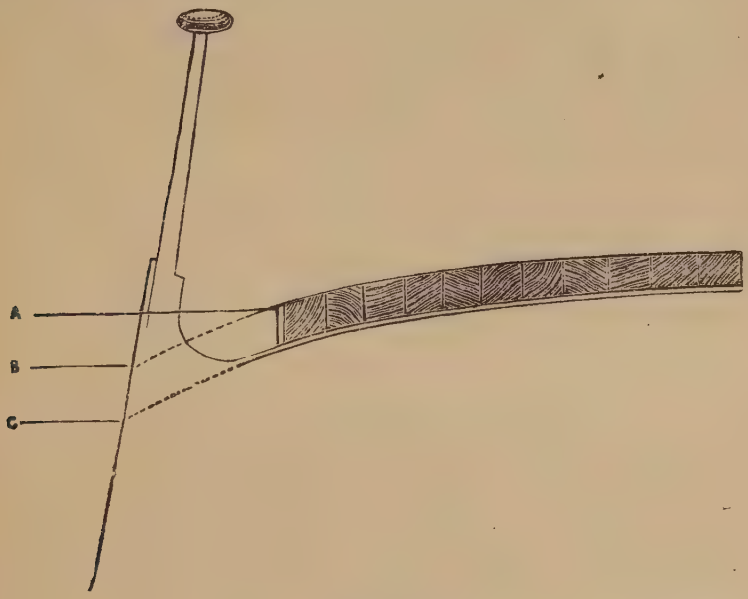



*Plate No. 145.*

* These Tables, with rules, can be procured at any nautical bookseller's.

British vessels are now marked by law. This section is however retained to shew (roughly how freeboard is arrived at.

board in the present day is measured; and though this anomaly may disappear in time, it will always be necessary to check this measurement on joining a strange vessel.

Having verified this matter and measured the amount of freeboard in feet and inches, from this last point to the centre of the disc, the master or mate in charge of the loading will have something to go upon, and until the vessel *has* been loaded it will be useless to trust to the fore and aft draught marks.

Whilst on the subject of the deck line, it is to be remembered that in an ordinary well-decker the freeboard is considered as though measured from a wood deck as in the sketch, even though she only have an iron one; or in plainer words, suppose that a ship, with a wood deck laid of 3 inches thick (in the well) *over* an iron deck, had a freeboard of 2 feet from the intersection of the curve of that deck with the side (*B in the sketch*). If the wood deck was taken away, leaving only the iron deck, she would then only require 1 foot 9 inches from that deck, *C* in sketch, thus *getting the credit of the wood deck whether it was there or not.* This rule applies to all ships of this kind if $\frac{7}{10}$ of their length is covered by erections, such as bridge, poop, &c. [For less total erections a less proportionate allowance is given.] (*See paragraph 6 in explanation.*) *Plate No. 146.*

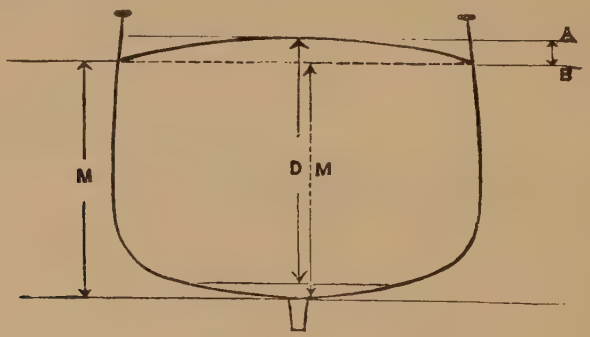



*Plate No. 146.*

Paragraphs 1 to 4 in the explanations explain clearly the first step in working a freeboard, namely, the arrival at the co-efficient of fineness, or in plain words, the amount that a vessel's shape departs from a box-like form.

The next thing to arrive at is the *moulded depth* (*paragraph 5 in explanations*). *Plate 146.*

The accompanying sketch shews what this is. Here *M* is the vessel's moulded depth, and it will be seen that this can be got inside the vessel whenever it is necessary to do so; for *D* being the depth of hold *at the middle* of the vessel's length, add to this the depth of floors, and subtract from the sum the amount of *camber* of the deck, and you at once have the moulded depth required. (The camber can be got by the simple means of stretching a line horizontally across the vessel's deck, when the distance *A B* is the camber or round of beam required.)

We now, therefore, have the co-efficient of fineness, and the moulded depth.

Let us suppose we have an ordinary well-decker to deal with, and continue our calculations. Now, *to the main deck*, this vessel may be considered a flush deck ship; therefore we first enter Table *A* with the moulded depth and co-efficient of fineness (the question of length will come afterwards), which will give the corresponding height of freeboard amidships for winter (*i.e.*, from the 1st of October to the 31st of March). And if the vessel were flush decked without any erections and had normal sheer and camber, this would, without further calculation, be her freeboard.

But other matters now come in for consideration *(paragraph 16 of explanations)*.

First, sheer.—The tables are framed for vessels with a certain amount of sheer to length; vessels with *more* than this normal sheer are allowed a proportional *deduction* from their freeboard, and *vice versâ*. This sheer can usually be procured from the builder's plan of the vessel; if not, it must be measured from the vessel herself, and the procedure is as follows. First get the vessel, if possible, on an even fore and aft draught, and even keel. Next notice that the explanations say that the sheer is the sheer of the (main) deck measured at the side. It will be further seen (*paragraph* 16, *sub-paragraph* (*d*)) that it is to be measured from the middle of the length. Therefore in the sketch the difference between *A* and *C* will give the *after* sheer, the difference between *B* and *C* the forward sheer; the dotted line shewing the continuation of main deck, the sheer of which is required. These two quantities added together, and divided by two, equal the total mean sheer. It will be necessary to be very particular with the measurements to get an approximately correct result. The fore side of stem, and abreast of the aft side of stern-post, are the two points at which to measure the sheer in well deckers. This sheer will now have to be compared with the standard sheer for a vessel of similar length *(paragraph 16)*, and the difference taken between the two. This difference

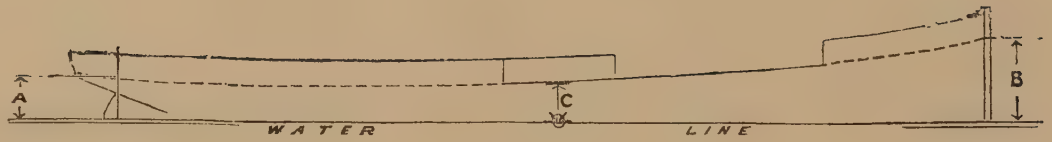



*Plate No. 147.*



## MEASUREMENT OF VESSEL'S SHEER

At fore side of stem and aft side of stern post.

Note that if the vessel has any list, it will be necessary to take a measurement on either side at the after end, and take the mean. The same will be necessary at **C** to get the mean freeboard.

divided by four will give the correction to be applied to the freeboard arrived at from the table. Any *ordinary* modern vessel's sheer is *always* in excess of the sheer given in the table *(paragraph 16)*; whenever this is the case the correction is subtracted from the freeboard found by Table *A*.

The next correction is for length. If the vessel's length is in excess of that in the table, there will be a correction to *add* to the freeboard, and *vice versâ*. This is regulated by paragraph 9, where, *note particularly*, that in nearly all well-deckers only half the correction in the table is applied; these vessels having over 6-10ths of their length covered by erections.

We now come to a more intricate correction, namely, that for erections. It will be remembered that thus far we have been considering the ship as flush-decked and of full strength. In dealing with the erections, we take them as equal to the strength (in scantling) of an awning deck, and they are to be allowed for under paragraph 2 in the manner therein described, which is as follows :—The freeboard answering to the co-efficient of fineness and moulded depth is taken out from Table *C* as it was from Table *A*. The difference (*) between this and the freeboard by Table *A*, corrected for sheer, is then taken. Suppose then that 7-10ths of the vessel's length is covered by erections, $\frac{63}{100}$ of this difference (*) is to be taken, and the freeboard diminished by that amount, and so on in proportion as the paragraph directs. When this correction has been arrived at, a deduction is made by the table (in sub-paragraph (*c*) if the raised quarter-deck is less than 4 feet in height.

There is now a small correction for round of beam to apply by paragraph 17. This is seldom more than half an inch.

A most important correction now comes in *if* the vessel has an iron deck in the well *not* wood covered. Should this be the case, and the total length of her erections equal to 7-10ths of the length, the full thickness of an ordinary wood deck (in most cases $3\frac{1}{2}$ inches) is deducted from the freeboard (for less length of erections, see paragraph 6, sub-paragraph (*b.*)

This is the last correction, and the vessel's freeboard for winter is now arrived at, subject to two further conditions, namely—that she has proper arrangements for the crew to get along between the forecastle and bridge, and also a sufficient number of clearing ports in the well. (See paragraph 11, sub-paragraphs *e.* and *f.*) Unless satisfactory in these two respects, 1 per cent. of the moulded depth is added to her freeboard on account of each.

Different classes of ships are provided for by the tables, and to arrive at an exact freeboard is a matter for an expert; but these few remarks will help the learner to understand in some degree the tables which have been published by the Load Line Committee, and by which the present statutory freeboard is arrived at.

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## SECTION XLVIII.

# WINDS, WEATHER, AND BAROMETER; AND HOW TO FORETELL WEATHER.

### WEATHER AT SEA.

With a first-class modern steamer, in good trim, it matters little what the weather is under ordinary circumstances, so long as it keeps clear. But put even such a vessel in a hurricane district during the season and it will matter very considerably; and as this work appeals to all classes in sail and steam, an article on weather would not appear to be out of place.

There is much truth in the old doggrel weather rhymes, and an experienced seaman will often detect signs of a coming gale some time beforehand.

A red sky in the morning
Is the sailor's warning;
A red sky at night
Is the sailor's delight.

Read a *rainbow* for a red sky, and the same rhyme holds good.

In squalls—

When the rain's before the wind,
Topsail halliards you must mind.
When the wind's before the rain,
Soon you may make sail again.

---

At sea, with low and falling glass,
Soundly sleeps the careless ass,
Only when it's high and rising
Safely rests the careful wise 'un.

---

Mackerel sky and mares' tails
Make lofty ships carry low sails.

---

"The wind will blow hard when the gull comes ashore."

Seagull, seagull, sit on the sand!
It's never good weather when you're on the land.

Evening red and morning grey,
Are very good signs of a very fine day.

For the barometer—

First rise after low
Foretells stronger blow.

Long foretold, long last;
Short notice, soon past.

Hard-edged, oily (or greasy) looking clouds, tell of wind (called in some parts "pig's-eye sky").

Soft looking clouds—fine weather.

High upper clouds, crossing the sun or moon, in an opposite direction to the wind blowing, foretell a change to their direction.

A high dawn (that is, when the first streaks of light appear over a bank of clouds instead of near the horizon) foretells wind.

A low dawn—fine weather.

In the Northern Hemisphere turn your *back* to the wind, and the low barometer or storm centre is on your *left* hand. In S. lats. the opposite. This natural law is named, after its promulgator, Buys Ballot's law.

In the Atlantic, and about our own coasts, Bay of Biscay, North Sea, &c., the light mare's tail or brush-head cloud (*cirrus*), moving from N.W. on a fine day, is an almost infallible sign of the approach of a depression or storm system. High clouds such as this and the mackerel sky should always receive careful attention from the seaman who wishes to be able to foretell the weather.

This fore-mentioned *cirrus*, when seen lying at rest in faint cross lines, is a good sign of settled weather.

A mackerel sky moving fast (from the westward), or long feathers of *cirrus* radiating from the west, as is sometimes seen at sunset, are both signs of an approaching westerly gale

After a considerable period of very low barometer, accompanied by moderate or quiet weather, expect a gale from the north.

An *extremely* low barometer is sometimes followed by strong N.E. gales.

After running with strong westerly winds and a *slowly* falling or steady glass towards the channel, it sometimes happens that the wind flies to the W.N.W., and *afterwards* comes to N. and N.N.E. with a rapidly falling barometer. When this occurs, strong N.E. gales of some

duration are likely to follow, especially if it be early spring. Fourteen days of hard gales from E.N.E. to N. have been known to follow a change of this kind in the chops of the channel, with a glass down as far as 28·40 during the first day.

If the barometer has been at about an ordinary height, and is steady or rising, while the thermometer falls and the air gets drier, N.W.-N. or N.E. wind, or a decrease of wind may be looked for. On the contrary, if the glass fall, and the thermometer rises and the air becomes damper, S.E.-S. or S.W. wind may be expected with rain, or, in winter, perhaps snow.

An exception occasionally occurs to these rules when rain or snow from N.E. is approaching, before which the barometer will sometimes rise (on account of the *direction* of the coming wind).

If the barometer has been below the ordinary height, say about 29½ inches (29·5), a rise will foretell less wind, *or* a change towards the northward, *or* less wet.

If the barometer has been *low*, say about 29·0, then the first rise usually foretells a gale or heavy squalls from N.W.-N., or N.E. After such a gale has burst, if the glass still rise, *better weather is probable if it becomes colder;* but if it continues the same temperature or gets warmer, it is probable the wind will back, and that a S. or S.W. wind will follow.

The most dangerous shifts and the heaviest northerly gales come after the first rise of the barometer from a very low point.

A rapid rise of the barometer means unsettled weather.

A slow rise or a steady glass—fair weather.

Alternate rise and fall means unsettled weather.

A *rapid* fall—look out for a gale and rain.

If the glass falls for a northerly wind it will be wet and violent.

The great westerly gales of the Atlantic usually begin at S. or even S.S.E. hauling gradually to S.W. and W.S.W., blowing hard from that quarter with a falling glass and rain, the weather getting gradually thicker. Presently the glass stops falling, there is often a slight lull, with rain heavier than before, there is a lift to the westward, perhaps lightning, then away comes the wind in a heavy squall from W.N.W. The weather then generally clears, and the gale becomes squally with rain and hail from N.W.

The Southern Ocean gales act in a similar manner, except that they usually begin at N.W. or W.N.W. with thick weather, and shift to S.W. with clear weather and squalls, the glass falling during the time the wind is W.N.W.'ly, and usually beginning to rise just before the

shift to S.W. These gales, though often very heavy, especially in the N. Atlantic during winter, very seldom if ever reach the *extreme* force of a severe tropical hurricane, though their force is often recorded in Logs as 12 in Beaufort's scale—which is here given, as are also the letters which are in these days very generally used to indicate the state of the weather in a Log.

### WIND.

0. Calm.
1. Light air = steerage way.
2. Light breeze = 1 to 2 knots clean full in smooth water.
3. Gentle breeze = 3 to 4 knots „
4. Moderate breeze = 5 to 6 knots „
5. Fresh breeze = to which royals could be carried.
6. Strong breeze = to which topgallant sails could be carried.
7. Moderate gale = to which topsails, jib, &c. could be carried.
8. Fresh gale = to which reefed upper topsails and courses could be carried.
9. Strong gale = to which lower topsails and courses could be carried.
10. Whole gale = to which lower main topsail and reefed foresail could be carried.
11. Storm = to which storm staysails could be carried.
12. Hurricane = which no canvas could withstand.

### WEATHER.

*b* = Blue sky.
*c* = Clouds (detached).
*d* = Drizzling rain.
*f* = Fog.
*g* = Gloomy.
*h* = Hail.
*l* = Lightning.
*m* = Misty (hazy).
*o* = Overcast.
*p* = Passing showers.
*q* = Squally.
*r* = Rain.
*s* = Snow.
*t* = Thunder.
*u* = Ugly (threatening appearances).
*v* = Visibility (objects at a distance very clear).
*w* = Dew.

A line under a letter = heavy; a double line = very heavy, thus—*r* heavy rain; *r* very heavy rain.

### SEA.

0 = Calm.
1 = Very smooth.
2 = Smooth.
3 = Slight.
4 = Moderate.
5. Rather rough.
6. Rough.
7. High.
8. Very high.
9. Tremendous.

### CLOUDS

Are of four principal classes (which are subdivided into other classes of less importance).

1. The cirrus = mares' tail, and cirro-cumulus, mackerel sky.
2. The stratus = cloud lying in lines or layers (*strata*).
3. The cumulus = large massy cloud in different forms.
4. The nimbus or rain cloud.

Of these the first-class, cirrus, has already been mentioned.

The stratus is usually a sign of quiet weather, with perhaps fog or dullness.

The cumulus generally accompanies a polar wind, with moderately dry weather.

The nimbus, as a rule, accompanies a southerly or wet wind.

By far the most important for the seaman to observe are the *upper* clouds, namely, the cirrus and cirro-cumulus.

In high latitudes it is to be remembered that in lying-to in heavy weather, or head reaching, on *one* tack the glass will rise, on the other it will fall.

In the Northern hemisphere the glass will rise when on the starboard tack and fall on the port tack. In the Southern hemisphere it will fall on the starboard tack and rise on the port tack. Buys Ballot's law explains this thus:—

When your back is turned to the wind in the N. hemisphere, the low barometer is on your left hand; and as, when you are thus placed, a ship on the starboard tack is advancing towards your right, she goes towards the higher barometer. This is reversed in the S. hemisphere. It *may*, however, happen that a high pressure towards which a vessel is sailing is receding from her faster than she sails, in which case this rule would not strictly apply. Still, on the whole, it may be said that *in the Northern hemisphere a rising barometer on the starboard tack is not sufficient indication of improving weather*, and other signs should be looked for before trusting it. On the other hand, a rising barometer on the port tack is a valuable indication of improving weather, while a falling barometer on the starboard tack is an important warning in the other direction. This order will be reversed in the Southern hemisphere.

In the N. Atlantic, if hove to, or standing to the westward in a southerly gale, the glass will fall more rapidly than if running to the eastward, and worse weather may from this cause be expected than what is really coming.

In a weak or over-laden vessel bound to the westward, heave to on the starboard tack. Reverse this in the Southern hemisphere.

In the tropics the barometer, generally, moves much less than in high latitudes. In all places the glass has a daily range like a tide, being higher at about 8 or 9 A.M. and P.M. than it is from 3 to 4 A.M. and P.M.; and in high latitudes this is usually easily noticed; so much so that if the barometer remains steady from 3 o'clock to 10 or thereabouts it is equal to a fall, or if steady from 12 to 4 it is equal to a

rise. Now, in the tropics this range is very small, and, unless careful readings are taken, will scarcely be noticed. Therefore, in these latitudes it is necessary to take more notice of slight movements in the barometer than is necessary in high latitudes, more especially when in hurricane districts during the season.

The theory of hurricanes (cyclones, or circular storms) is pretty generally known to seamen of the present day, but for young seamen a few general remarks on the subject will be useful, more especially as a knowledge of it is now required by the Board of Trade.

Tropical cyclones generally originate in about lat. 10° N. or S.

Their form has till late years been taken as circular, although there is no doubt that they are more of an elliptical form, with probably the area of greatest force round the calm centre, at the hindermost focus of the ellipse. This was first suggested by the writer in a letter to the *Nautical Magazine* in 1881, and is now becoming generally received as correct. The accompanying sketch *(Plate No. 148)* will show the

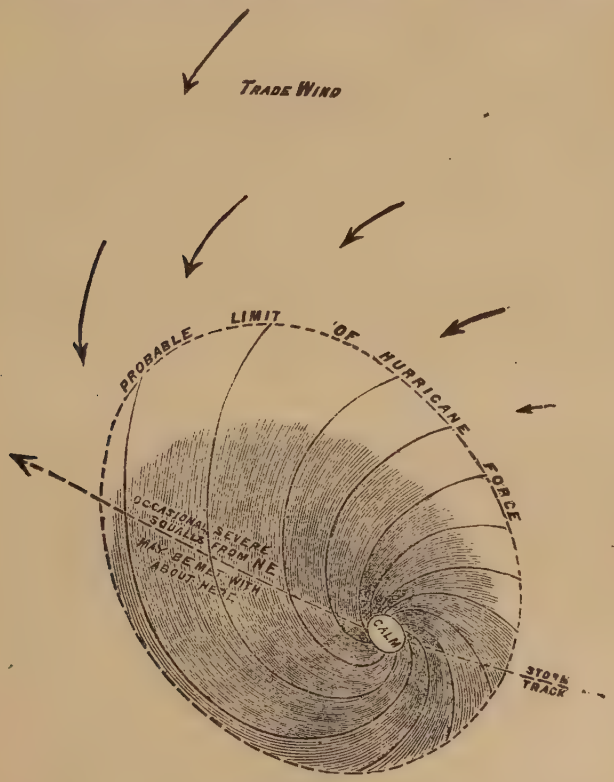

TRADE WIND
PROBABLE LIMIT OF HURRICANE FORCE
OCCASIONAL SEVERE SQUALLS FROM NE MAY BE MET WITH ABOUT HERE
CALM
STORM TRACK

*Plate No. 148.*

A West India Cyclone travelling to the W.N.W. in the N.E. Trade district.

elliptical theory as far as shape goes. The old and generally received idea was, that the wind in the limits of the storm blew in *a circle* round a centre spot of calm. The more modern, and now unanimous, opinion is, that the wind blows in spirals as shewn in the diagram, and that though blowing to some extent round the centre, it also blows in some degree *towards* that centre as well.

Generally these storms do not remain in one place, but move along bodily in a westerly direction. There are, however, exceptions to this

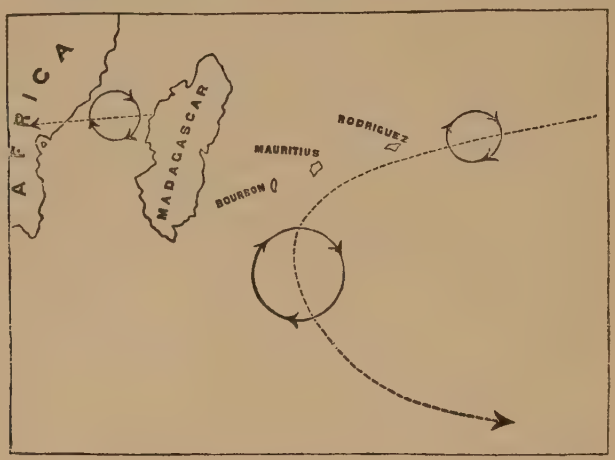



*Plate No. 149.*

rule, notably in the case of Mauritius hurricanes (*Plate No. 149*), which, moving S. W.'ly till near that island, often re-curve and go off in a S.E.

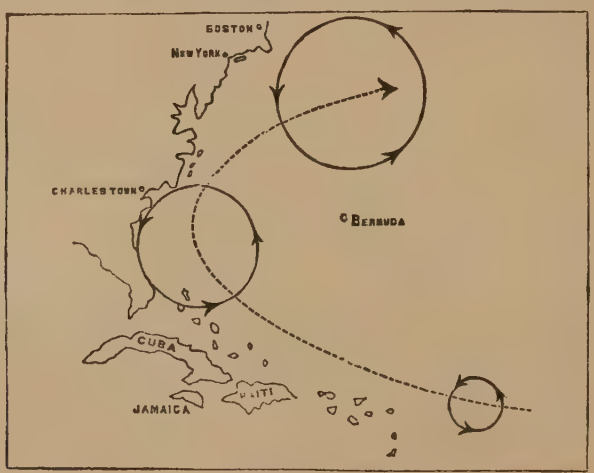



*Plate No. 150.*

direction. The W. India hurricanes also often re-curve when reaching the American coast and proceed coastwise (*Plate No. 150)*, sometimes reaching Nova Scotia, or even across the Atlantic. The cyclones of the Bay of Bengal also move in uncertain tracks, especially up at the head of the bay. And so also the typhoons of the China Seas.

Usually, however, the storm, after beginning in about 10° N. or S., moves off to the westward, and at the same time increases its distance from the Equator (that is, in N. latitude the direction is W.N.W.'ly; in S. lat. W.S.W.'ly).

As the storm moves forward it gradually increases in volume and in rate of progression.

Now, in dealing with these storms for the purpose of avoiding them at sea, the cyclone is considered as divided into two halves, called the RIGHT hand and LEFT hand semicircles. Supposing yourself behind the storm, in its track, the half of the storm on your right hand is called the RIGHT hand semicircle, the one on your left hand the LEFT.

Now in Northern latitudes the wind in a cyclone blows spirally towards the centre against the hands of a watch, or against the sun. In South latitudes the opposite way.

Knowing these two facts, the first thing to be done if a cyclone is approaching, is to find the bearing of the centre. One of the first rules in foretelling weather (see beginning of this article) is: turn your *back* to the wind and the low barometer and storm centre is on your *left hand* in North latitude. In South latitudes the opposite. This rule applies in the same way to cyclones. Now, if the circular theory were correct, the centre would bear *square off* on your left hand or 8 points from the wind, but as the spiral theory is without doubt more correct, this old rule will not absolutely hold good; and it is nearer truth that *when actually in the storm area* the centre will bear *11 or 12 points* from the wind instead of 8. Thus if the wind were N. the centre would bear about S.E. by E. This rule will hold good throughout the area of hurricane force, except, perhaps, in the immediate rear of the storm, where the centre may possibly bear as much as 13 or 14 points from the wind. Thus, supposing a vessel to be sailing after (and into) a slowly travelling cyclone, it is doubtful if any rule will help her, so that great caution is necessary, and with cyclonic indications, in a district *where storm tracks are westerly*, if your wind is anywhere from E.N.E. to E.S.E. in either latitude it is *most unsafe* to run, and the wise course is to heave-to on the right tack, or if possible make easting. Many vessels having stood to sea from Port Louis, Mauritius, by the port-warden's order, have found an easterly wind outside, and sailed into the hurricane they left port to avoid.

But if the ship's position in the storm has been found as well as can be judged, then the proper rules are:—

In North latitude—*If in the right hand semicircle of the advancing storm, with the wind shifting to the right hand, heave-to on the starboard tack. If in the left hand semicircle, run (unless the wind is between the points mentioned above), but in any case keep the wind on the starboard quarter. Then if the glass rises you may heave-to on the port tack if you are running out of your course.*

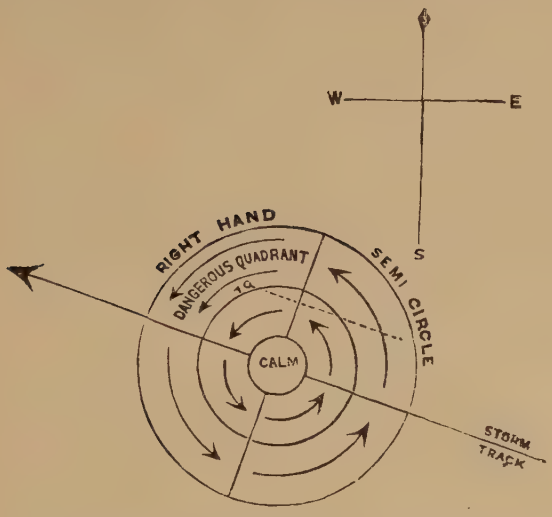
In South latitude—*If in the right hand semicircle, run with the wind on the port quarter, except with the wind in the aforementioned limits; then if the glass rises, heave-to on starboard tack. If in the left hand semicircle, heave-to on the port tack.*

If you judge your position to be in the *direct line* of the advancing storm, *run*, but be sure before you do this that you are not in the dangerous quadrant.

If in the direct line of advance, the wind will be steady from one point; but if it is eastward of North in the Northern hemisphere, or eastward of South in the Southern hemisphere, in districts where storm tracks are westerly, it will show you that the ship is at present in the dangerous quadrant; and, therefore, it will not do in such a case to act hurriedly, even though the wind may appear to be steady. (*Occasional* severe *squalls* from N.E. or S.E. may be experienced in such a position, but the *prevailing* direction of the wind is now being spoken of.)

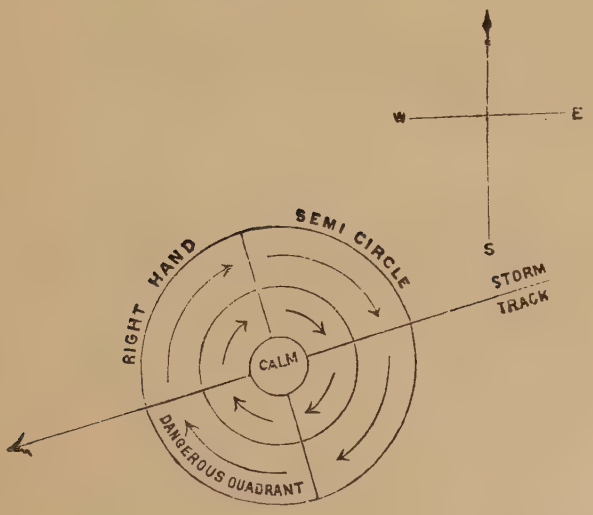
Now, to know whether you are in this most dangerous part of a storm—*i.e.*, the danger quadrant—it is necessary to note particularly the direction of the wind, how it is shifting or acting, and how the barometer is moving. The directions under the old circular theory were as follows:—If not possessed of one, make a transparent storm card thus:—Draw on a sheet of thin note paper a diagram, similar to the one here shewn; dip the paper in spirits of turpentine or oil, and dry it. Then place this paper over your position on the chart, and you will have a fair representation of the storm considered as circular. Now move it until the direction of the wind by the card corresponds to the wind you have, and your place on the chart will then shew your position in the storm. Suppose you were North of the Line, and you made the wind to be N.E., and decided your position was at *A*, it would not do to run the ship, for, remembering that the storm is advancing in the direction of the arrow through its centre, it will be seen that this proceeding would be nothing more than approaching the centre of the storm, and unless the vessel

could run *across* the track in front, she would stand a great chance of being caught in the dangerous centre, which is of all things to be avoided. In such a position it would be more judicious to heave-to, and being in the *Right* hand semicircle, to heave-to on the *Starboard* tack; in which case the part of the storm shewn by the dotted line




A storm card for the Northern Hemisphere. Old circular theory

*Plate No 151.*

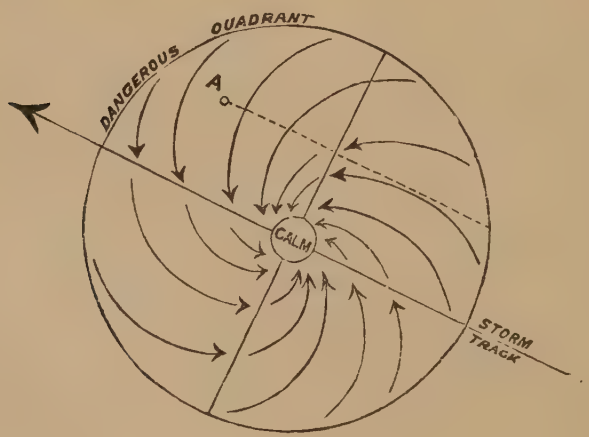



A storm card for the Southern Hemisphere. Old circular theory

*Plate No. 152.*

would pass over the vessel, and she would find the wind gradually hauling to the E. and S.E. When the wind got this far (S.E.), but not before, it would shew that the centre of the storm was past, and it would then be safe to run with the wind on the *starboard* quarter if the sea would allow, and if it would expedite the voyage. But if after starting to run, the glass stops rising, heave-to again, as the storm might be re-curving. To show the reason for heaving-to on the proper tack. If this vessel had been hove-to on the *port* tack, the wind would have kept *heading* her and breaking her off; whilst as it is she "comes up" as the wind changes, and will not be caught aback. The reason for running with the wind on the *quarter* is that the vessel thus increases her distance from the centre, and this is especially necessary if the spiral theory is accepted; in fact it will be sometimes found that though the ship is running with the wind quarterly, the glass still falls, shewing she is *not* decreasing her distance from the centre. In such a case the wind must be brought more quarterly, and if she will not stand this, prepare for the worst—heave-to. If possible, get the upper yards down, and see everything secured as far as possible, for fear the centre of the storm may overtake and pass over the vessel.

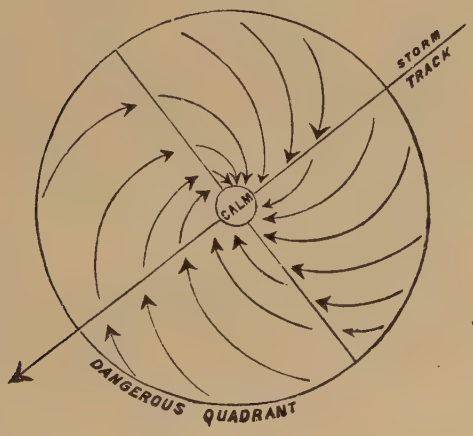
But as the spiral theory is undoubtedly nearer truth than the circular, it will be still better to make a storm card which will suit that theory. Such a card is here shewn, from which it will be seen




Storm card for Northern Hemisphere. New spiral theory. Centre bears 11 points from the wind throughout the storm.

*Plate No. 153.*

that the vessel at *A* will not have the wind at N.E., but at about North, or perhaps N. by E., and by the time the wind had reached N.E., the centre of the storm would be abreast of her; so that, though under the old law of storms it was permissible, in a storm travelling about W.N.W., to run the ship with the wind N.N.E., the new theory shews that this is not a safe thing to do.




Storm card for Southern Hemisphere. New spiral theory. Centre bears 11 points from the wind throughout the storm

*Plate No. 154.*

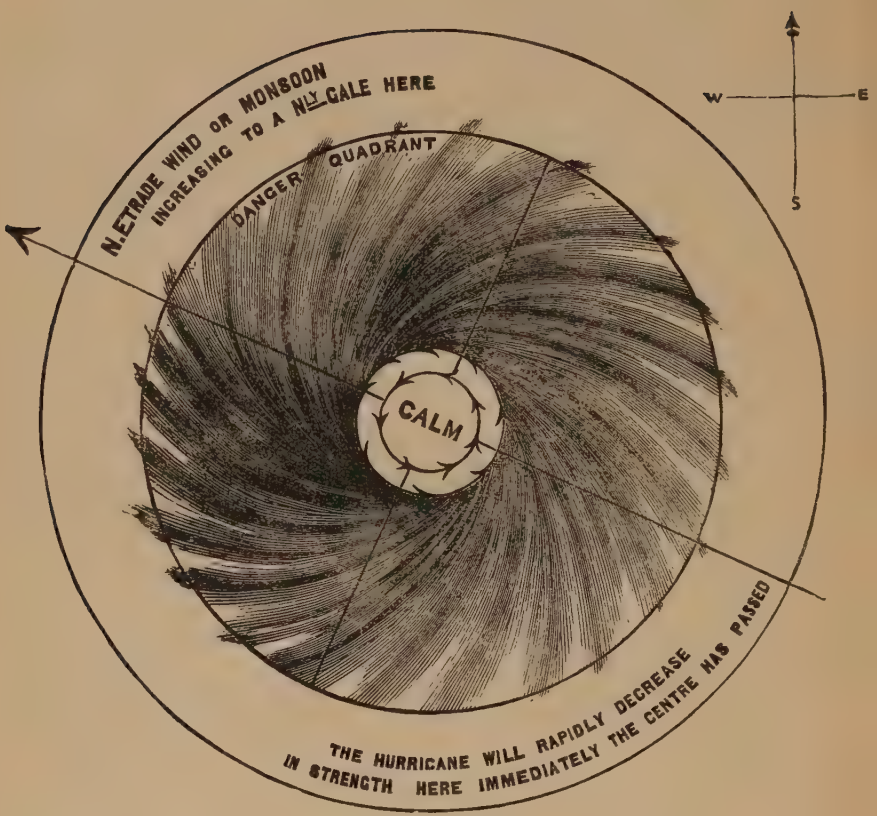



*Plate No. 155.*

### In the Danger Quadrant.

In N. lat. Turn your back to the wind = scudding with wind dead aft, and the storm centre will bear about 4 points on port bow. Probably, however, this rule will not exactly hold good in the Left Hand Semicircle, where the curvature will be greater—(*see Plate No. 158*)—and where a ship might be running with the wind, say, at N. by W., and within half an hour find it round to S.W.; and in this part of the storm it would be possible to have the centre bearing 6 points on the bow with the N. by W. wind, and, if still scudding, only 2 points on the bow with the wind S.W. In the immediate rear of the storm the wind may be found blowing nearly straight for the centre; the centre thus bearing, say, 2 points on the bow, with the wind aft.

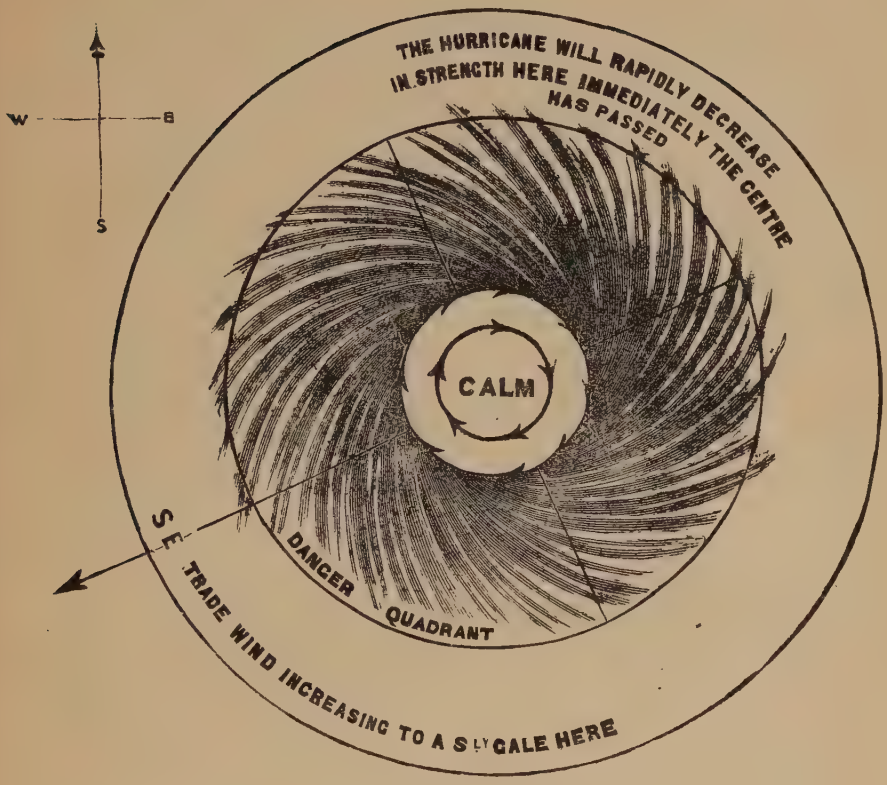

W
E
S
THE HURRICANE WILL RAPIDLY DECREASE IN STRENGTH HERE IMMEDIATELY THE CENTRE HAS PASSED
CALM
DANGER QUADRANT
S.E. TRADE WIND INCREASING TO A S.LY GALE HERE

*Plate No. 156.*

### In the Danger Quadrant.

In S. lat. Turn your back to the wind = scudding with wind dead aft, and the storm centre will bear about 4 points on starboard bow. Probably, however, this rule will not exactly hold good in the Right Hand Semicircle, where the curvature will be greater—(*see Plate No. 157*)—and where a ship might be running with the wind, say, at S. by W., and within half an hour find it round to N.W.; and in this part of the storm it would be possible to have the centre bearing 6 points on the bow with the S. by W. wind, and, if still scudding, only 2 points on the bow with the wind N.W. In the immediate rear of the storm the wind may be found blowing nearly straight for the centre; the centre thus bearing, say, 2 points on the bow, with the wind aft.

The foregoing remarks principally apply to sailing vessels. A well-

equipped steamer can always get out of a cyclone if acting *in time* by steering with the wind well on the starboard *side* in North latitude; on the port *side* in South latitude, unless in the dangerous quadrant.

It may be that a vessel is in a position where she cannot get out of the way of an approaching storm; every care that experience can suggest will of course in such a case be taken to prepare for the worst. In most Indian anchorages, and at Mauritius, the vessels are warned by the port-warden, and have to make best use of that warning of getting to sea, and, if possible, keeping clear of the track of the approaching storm. Steamers in Port Louis have sometimes run themselves on the mud, opened their sea-cocks and run their ballast tanks full, and in this position weathered a cyclone in safety. In bringing up to ride out a hurricane it is perhaps best to trust to *one* anchor with the full scope of cable; with both down they may foul with the shifting wind, and perhaps trip each other out of the ground, and cause the ship to drive.

A ship rode out in safety a severe cyclone at the Sandheads, with one anchor down and the cable out to the clench, the master, a most experienced man, preferring to chance one anchor to dropping the other also. The topgallant and royal yards were got on deck before the worst of the gale; but when the heaviest came (a severe shift to S.W.) she lay over as if under a heavy press of canvas, and the three bare topgallant masts blew clean out of her. A ship which was about a mile off at the time was attempting to clew up a close reefed main topsail, when her three topmasts went over the side, carrying the lower-mast heads with them. (This shews that with good ground tackle there is a reasonable probability of a vessel riding out one of the worst of these storms.) The wind in this gale began at E. by S., with torrents of rain; then shifted S., then S.W., afterwards to N.W. The heaviest was, as above stated, from S.W.; after the wind began to shift it was round to N.W. in little more than two hours; but a heavy sea from S.E. continued for some time. It was concluded that the east or right hand side of a cyclone, and very near the centre, passed over the vessel, the track of the storm being nearly due North, as in this part of the Bay they often are.

It may perhaps be useful to give a short account of another cyclone off Madras.

11 A.M.—wind N.N.W., in lower topsails, ship labouring terribly, and a frightful sea running. Hauled down fore topmast staysail, and brought her to the wind with a boat's sail in mizzen rigging.

Noon—blowing a hurricane, wind N.W., ship lying with lee side of main deck in the water.

Barometer, 1 P.M. = 29·40
„ 2 „ = 29·25
„ 2.30 „ = 28·96
„ 3 „ = 28·80
„ 3.30 „ = 29·2
„ 4 „ = 29·22

3.20 P.M.—a tremendous gust from W.S.W. laid the ship on her beam ends, washed away the lee boats, jib-boom went in the cap, taking with it fore topgallant mast, lee main rail all washed away, and mizzen stay parted. The wind then began to haul S.W., and decreased rapidly; by 4 P.M. it was S.S.W., and the hurricane was over. The gale was travelling nearly due W. Previous to the hurricane the wind had been from N. to N. by W., with dangerous squalls from N.E., the glass falling for twelve hours beforehand.

A case of a steamer may be useful.

S.S.——, in the month of May, lat. 19° N., long. 89° E., bound to the S.E.

Wind S.E. to E.S.E. and E. Went half speed. Wind changing E. by N., E.N.E., N.E., N.N.E. Barometer rapidly falling; hurricane increasing. Kept away S.W. by W., and more to the S. as wind hauled N. and N.W.

Finding great difficulty in keeping her from coming to, filled a double gunny bag with cocoa-nut oil and put it in the weather ash-shoot. This made a marked difference in her behaviour; and the sea, which before was coming aboard in tons, now ceased breaking, and the vessel was enabled to steer safely out of the centre of the storm.

The time when hurricanes are most prevalent is—in N. lats., from July to October; in S. lats., from December to April. In the Arabian Sea and Bay of Bengal the worst times are April to June, and October to the beginning of December.

The area of a cyclone varies from 20 to 30 miles diameter, to some hundreds of miles.

A Table of Recorded Hurricanes

| | Jan. | Feb. | March. | April. | May | June. | July. | August. | Sept. | October. | Nov | Dec. | Total. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| W. Indies (300 yrs.) ... | 5 | 7 | 11 | 6 | 5 | 10 | 42 | 96 | 80 | 69 | 17 | 7 | 355 |
| S. Indian Ocean (39 yrs ) ... | 9 | 13 | 10 | 8 | 4 | — | — | — | 1 | 1 | 4 | 3 | 53 |
| Bombay (25 yrs.) ... | 1 | 1 | 1 | 5 | 9 | 2 | 4 | 5 | 8 | 12 | 9 | 5 | 62 |
| Bay of Bengal (139 yrs.) .. | 2 | — | 2 | 9 | 21 | 10 | 3 | 4 | 6 | 31 | 18 | 9 | 115 |
| China Seas (85 yrs.) ... | 5 | 1 | 5 | 5 | 11 | 10 | 22 | 40 | 58 | 35 | 16 | 6 | 214 |

The rate of progression of these storms (their usual tracks have already been mentioned) may be averaged at 300 m. per diem in the W. Indies; in the Arabian Sea, Bay of Bengal, and China Sea, 200 m. a day; in the S. Indian Ocean, from 50 to 200 m. a day.

The indications of an approaching hurricane are the usual ugly and threatening appearances which come before most severe storms, and the increasing number and severity of the *gusts* with the increasing wind. These signs are sometimes preceded by a long heavy swell and confused sea, which will come from the direction in which the hurricane is approaching.

In the trade wind districts, the earliest indication of a coming cyclone are a fresh breeze, and dry and transparent atmosphere. A long swell from the direction of the coming storm, and light feathery plumes of *cirrus* cloud, sometimes radiating from a point on the horizon where a whitish glare indicates the bearing of the storm. The cirrus gradually overspreads the sky, making halos round the sun and moon, and the falling glass gives indications of the storm's approach. The air becomes moist and heavy, with a freshening wind and squalls of misty rain, until it becomes evident to the most careless observer that bad weather is coming.

As to the bearing of the centre (before mentioned). The last instructions issued by authority say that at a considerable distance from the centre, and *before* the barometer shall have fallen much below normal, the centre may possibly bear 10 or 12 points from the direction of the wind. *But after the barometer has fallen five or six tenths of an inch,* it is probable that the bearing of the centre may be taken as *eight points* from the wind's direction.

As to the dangerous semicircle. In the Northern hemisphere the semicircle with veering winds is the dangerous one (the ship being hove-to). In the Southern hemisphere the semicircle with backing winds is the dangerous one.

The re-curvature of the hurricane path always takes place towards the side on which the dangerous semicircle is situated, namely, to the right in the Northern, to the left in the Southern hemisphere.

Thus, taking a W. India hurricane. So long as it is travelling to the Westward, the wind in front of the advancing centre is Northerly (N.N.W. to N.N.E.). As it turns to the North the wind in front is E.'ly, and after turning to the East the wind in front is S.E.'ly. (A S.E. gale in winter in the N. Atlantic, with ugly appearances and falling glass, will generally turn into one of the *dangerous* and terrific cyclonic gales sometimes met with at that season.)

A similar sequence will arise in the case of a re-curving hurricane off the Mauritius, but in the opposite order.

Now taking these storms as re-curving in about lat. 30° N. or 26° S. The following are the most dangerous wind directions, because, if steady from that point with a fast falling glass, the ship is on the path of the storm, and directly in front of it, thus in the position of greatest peril.

| N. Hemisphere. | | S. Hemisphere. | |
|---|---|---|---|
| Between Equator and 30° N. Lat. | N.N.W. to N.N.E. | Between Equator and 26° S. Lat. | S.S.W. to S.S.E. |
| About 30° N. | E.N.E. to E. | About 26° S. | E.S.E. to E. |
| Northward of 30° N. | S.E. | Southward of 26° S. | N.E. |

When in regions and seasons of cyclones, watch the weather, and constantly and carefully *observe and record* the Barometer.

When there are indications of a cyclone, heave-to, and carefully *observe and record* the movement of the barometer and changes of wind, so as to find the bearing of the centre, and ascertain which semicircle the ship is in. *Everything depends on heaving-to in time.*

The proper rules as to running and heaving-to have already been given.

In the case of Mauritius hurricanes, a vessel approaching a cyclone on its southern side always encounters a strong trade wind, freshening to a gale. It is difficult to tell when the trade forms part of the storm circle, consequently the bearing of the centre can seldom in this position be inferred from the direction of the wind; it is therefore recommended in such circumstances to heave-to and watch. When the wind has decidedly shifted to the East or South, the passage of the centre with respect to the ship's position may be approximately inferred; then *when the glass has fallen six-tenths of an inch from its height at the commencement of the gale*, the bearing of the centre may be taken as nearly at right angles to the direction of the wind. *(Plate No. 157.)*

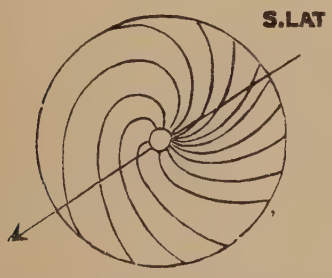



*Plate No. 157.*

Diagram shewing probable extreme curvature in the right hand semicircle, and wind blowing nearly direct for centre in rear of storm

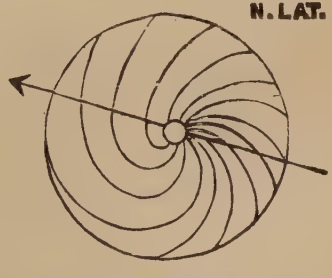



*Plate No. 158.*

Diagram shewing probable extreme curvature in the left hand semicircle, and wind blowing nearly direct for centre in rear of storm.

In these cyclones it is nearly always the case, as before mentioned, that winds at N.E. and E. are, until the storm re-curves, blowing almost directly towards the centre, so with those winds make what easting you can,—*be sure not to run;* and in this district, with a freshening N. or N.E. wind, or falling glass and ugly appearances, *look out and heave-to in time. (Plate No. 138.)*

In approaching a W. Indian hurricane (*before* it reaches the islands) on its northern side, you will probably have a strong trade-wind, and it will raise a similar difficulty to that of the Mauritius hurricane and the S.E. trade.

In approaching the Bay of Bengal from the southward, between June and September, if the weather gives cyclonic indications, it is almost certain that the storm centre is to the northward of 16° N. In the months of July and August the storm will probably be still further north, and not further south than 19° N. The tracks are *usually* N.W.ly, but this cannot be depended upon. In the worst hurricane months, however, that is, May, October, and November, the cyclones may be met anywhere in the Bay to the northward of 8° N.

Hurricane tracks in the China Seas are too variable to be indicated with safety.

In conclusion, the chief thing to be done, if at sea with all indications of an approaching cyclone, is to consider the state of things calmly and quietly, and to give sound judgment the best chance of arriving at a correct estimate of the bearing of the storm's centre, and the direction of the storm's track; then, having decided the matter, *act at once*, and watch the barometer very carefully, and also any change in the direction of the wind. If this does not shift as you were expecting, reconsider your position, for remember that a sailing ship once drawn into the vortex or storm centre, is helpless, and in a position of great danger.

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SECTION XLIX.

## ON COATING THE BOTTOM OF IRON OR STEEL SHIPS.

Much has been written and argued on this subject, though, unfortunately, most of it has been special pleading for some particular composition, but the results of modern scientific enquiry, in brief, would seem to have established the following facts.

To apply a PROTECTIVE composition properly, the hull must be perfectly dry, or else the composition must be of a kind not affected by water.

Red and white lead paints are not now used to the extent they were, for it is proved that they deposit metallic lead under the action of sea water; galvanic action is set up between the lead and the iron, and wasting of the iron is the result.

Black varnish applied hot to perfectly dry plates is about as good a protective as it is possible to get, and is much used in the coasting trade without any anti-fouling composition over it.

Varnishes mixed with turpentine or naphtha are acted on by moisture, which destroys the hold of the varnish on the hull, and for a perfect protection several coats are necessary. With mixtures of this sort dry weather is a necessity, and they must be allowed to harden before the ship is again floated.

Varnishes with body given by mineral oxides are better, if the solvent used is not too rapid in its evaporation, and if the ingredients do not act against each other, and have no properties injurious to the vessel's plates. Red oxide of iron is the most generally used of this class; but in the opinion of a very high authority metallic zinc would be better.

Mixtures of this last sort, or else black varnish, are the best protectives.

The plates should be as dry as possible whilst a protective coat is applied, which should not be mixed too thick, or it will not fill up all the small holes and irregularities, and thus to some extent fail.

A good existing coat of composition should not be disturbed, unless there are evident signs of rust underneath.

A *new* ship should be washed over with dilute acid to get rid of *every trace* of mill scale; then washed down with a mild alkaline wash, and again washed off with fresh water before the protective is applied.

## ANTI-FOULING COMPOSITIONS.

Ships trading in high latitudes, North or South, foul much worse in the summer months, April to August inclusive, than in winter.

Vessels foul worse at anchor than under way; ships lying in brackish water foul more quickly when they go to sea than vessels that have been lying for the same time in salt water.

Certain parts of the world are far worse than others. A sailing vessel that had been trading on the Chilian coast for some time, when beached for cleaning, presented a spectacle which was almost past belief. The shell growth was fully eight inches thick, and in some parts more.

Exfoliating compounds, or, in other words, those that flake off, are better anti-foulers than poisonous ones; the old favourite mixture of white lead, tallow, and resin, put on as hot as possible, being a very good one, and unpatented. The writer made a four months' voyage in a steamer to the American Pacific coast with this composition, and on return there was hardly a trace of fouling on the vessel.

What has been said, then, can be resolved into this:—That if a new ship's bottom is to be well cared for, it must first be specially prepared as before mentioned; then carefully coated with a preservative, and this when dry must have an anti-fouling coat. The reason of many partial failures in these compositions is, without doubt, that they are put on too hurriedly. The hull is not dry enough to receive them, and the ship is floated again before *they* are dry.

It is most important that these matters should be attended to, especially in steel vessels, where it is hard to get anything to stay on, owing to the smoothness of the material; and unless more care is taken in these matters, considerably larger repairs will be wanted in years to come owing to wasted plates.

The young officer should, when his vessel is docked, make up his mind that careful supervision over the painters is needful, and that, if there is night work especially, his presence is absolutely necessary. It is not by any means a pleasant job to be standing about in a dry dock on a cold night with a few inches of water under foot; but if a ship is to be well coated, it is one of the important duties that the mate of a vessel should not shirk.

# THE INTERNATIONAL SIGNAL CODE.

Some years ago the Board of Trade awoke to the fact that signalling in the Mercantile Marine was very slack. With the exception of knowing the lettered representations of the various flags and a rough knowledge of the "distant signals," of which arms and balls formed the principal parts, little was attempted.

In 1899 the International Code of Signals was revised and made much more efficient, and soon after that the use of the semaphore and the Morse code came much into evidence. The examination in these became further advanced, and encouragement given to young officers to pass higher tests, having the successful results endorsed on their certificates. Many went through a course of that subject under the tutorship of experienced naval signalmen, and taking all in all, a high state of efficiency has been attained. There is this difference, though, between the two services, for whereas the Royal Naval vessels carry recognised trained signalmen the Mercantile Marine do not, nor have they, in the great majority of cases, any necessity to do so.

During the war a large percentage of Mercantile Marine officers obtained commissions and served in the auxiliary forces of the Royal Navy; here, again, was the means of a further advancement in all branches of signalling, and as on their return to the merchant service this work falls to their lot, their late experience will be very beneficial to them.

A great many shipping companies do not offer much encouragement in signalling, as they submit that their officers are responsible for the navigation and safe conduct of their property, and any undue attention to signalling would distract their attention from their duties. Now, as few vessels carry any officer beyond the number which is absolutely necessary, they have no time for exercise and steamers pass and repass one another without taking the opportunity to exchange messages.

Referring to the International Code of Signals first. The chief form of efficiency lays in the rapid reading of the flags in the hoist and the subsequent translation from a code.

The middle pages of the book form the index, and this can be opened by means of a green tape which should always be left in a horizontal position and not pulled to the top or the bottom as a book mark would probably be. If the latter was done it would defeat the object for which it was designed, namely, to open the book by its means at short notice.

Page 395*a* represents the middle pages as they would appear if the book was opened properly, and I should advise any student of signals to make himself thoroughly conversant with this, for by so doing he would master the main points of the International Code of Signals. Commit it to memory, and so be able to place your finger on any section without hesitation.

Remember, too, that by means of this book an interchange of signals can be accomplished between vessels of different nationalities and languages.

The writer has often opened this International Code of Signals before young officers and has intimated to them that he was going to ask them a few questions on its uses and peculiarities, and, during the questioning, has watched their eyes to see which side of the book they were going to glance when a query was put to them. If the officer looked at the right hand side page for one or two flag signals,

or to the left for four flag signals, then he knew very little about the book. If he was asked to decode the flags Z. O. B., and he turned up the end of the three flags signals for it, then he was once more astray, for the last signal of that nature is Z. N. V., and flags running in alphabetical order after those, except for a few that may be still left with blanks opposite to them, are only to be found in the British Signal Manual, of which more hereafter.

To tabulate them roughly :—

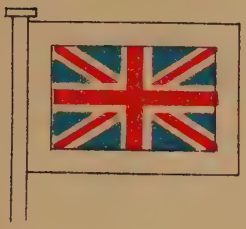
| | | |
|---|---|---|
| One or two flag signals are urgent and important signals (left page) | | |
| Three flag signals. | A superior | Compass signals, money, etc. (left page). |
| „ „ „ | B „ | General vocabulary (left and right page). |
| „ „ „ | Code flag „ | Lat. and Long., Time, Bar. (right page). |
| „ „ „ | Code inferior | Numeral signals (right page). |
| Four „ „ | A or B superior | Geographical signals „ „ |
| „ „ „ | C . | Spelling Table „ „ |

Distant Signals, Semaphore and Morse follow the above. Now you have the more important factors before you. The next point at issue is—"Don't scratch at the indices on the cut laps at the edges of the book."

Supposing now that you wish to turn up the signals of Lat. or Long., then place the thumb (clean) of your right hand gently on the Code flag over two flag section and with your fingers of the same hand under the cover of the book, turn that half of the book over from right to left until your thumb nearly touches the opposite page, now turn it back again to the table without loosening the grasp of your right hand, and you will find the section that you require open before you, having left the unsought for pages laying over on the left-hand side of the book.

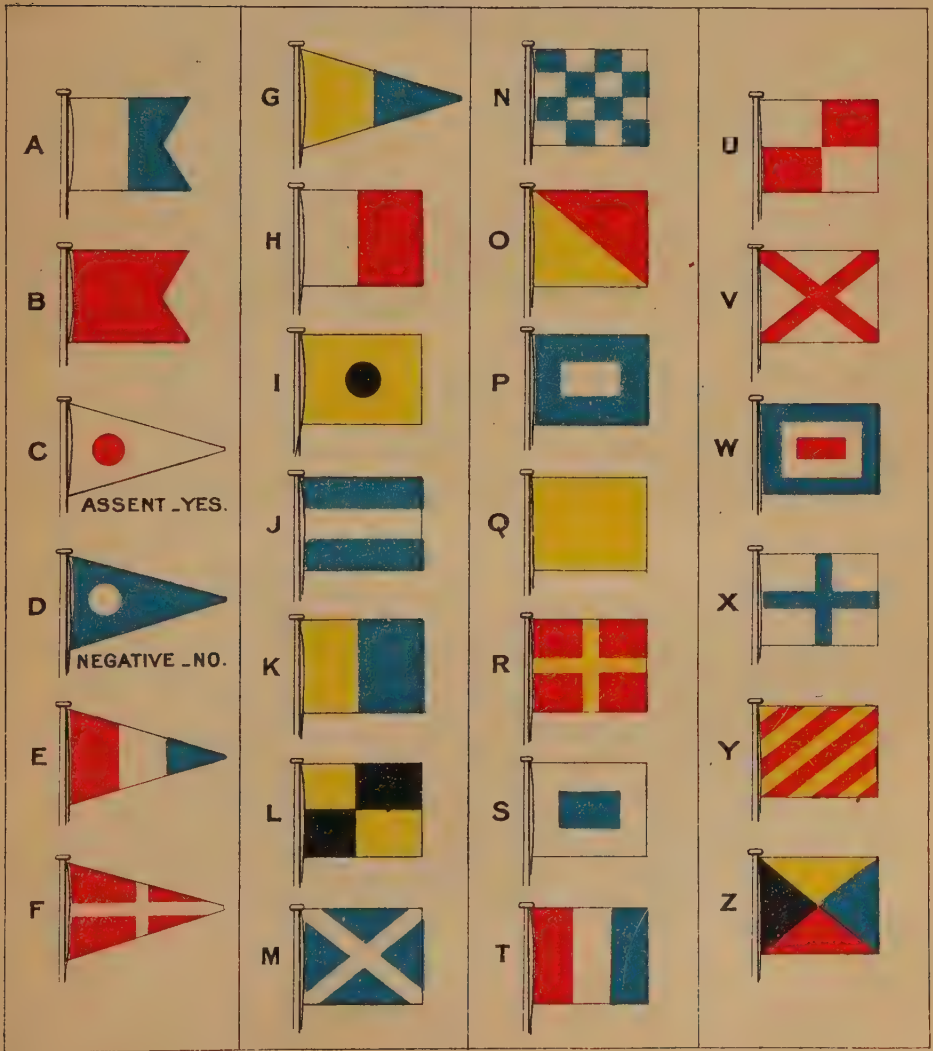
# INTERNATIONAL CODE OF SIGNALS.

PILOT JACK



"CODE SIGNAL"
AND "ANSWERING PENNANT."

When used as the "Code Signal" this Pennant is to be hoisted under the Ensign; when used as the "Answering Pennant" where best seen.



## SIGNALS OF DISTRESS.

*When a vessel is in distress* and requires assistance from other vessels, or from the shore, the following shall be the signals to be used or displayed by her, either together or separately :—

IN THE DAYTIME :—

(1) A gun or other explosive signal fired at intervals of about a minute ;
(2) The International Code Signal of Distress indicated by NC ;
(3) The distant signal, consisting of a square flag, having either above or below it a ball or anything resembling a ball ;
(4) The distant signal, consisting of a cone point upwards, having either above it or below it a ball or anything resembling a ball ;*
(5) A continuous sounding with any fog-signal apparatus.

AT NIGHT :—

(1) A gun or other explosive signal fired at intervals of about a minute ;
(2) Flames on the vessel (as from a burning tar barrel, oil barrel, etc.) ;
(3) Rockets or shells, throwing stars of any colour or description, fired one at a time at short intervals ;
(4) A continuous sounding with any fog-signal apparatus.

---

## SIGNALS FOR A PILOT.

The following signals, when used or displayed together or separately, shall be deemed to be signals for a pilot :—

IN THE DAYTIME :—

(1) To be hoisted at the fore, the Union Jack, having round it a white border, one-fifth of the breadth of the flag ;
(2) The International Code Pilotage Signal indicated by PT ;
(3) The International Code Flag S, with or without the Code Pennant over it ;
(4) The distant signal, consisting of a cone point upwards, having above it two balls or shapes resembling balls.

AT NIGHT :—

(1) The pyrotechnic light commonly known as a blue light every fifteen minutes ;
(2) A bright white light, flashed or shown at short or frequent intervals, just above the bulwarks for about a minute at a time.

Section 615 (3) of the Merchant Shipping Act, 1894, provides that "If a master of a vessel uses or displays, or causes or permits any person under his authority to use or display, any of the pilot signals for any other purpose than that of summoning a pilot, or uses or causes or permits any person under his authority to use any other signal for a pilot, he shall for each offence be liable to a fine not exceeding twenty pounds."

---

* This is purely a Code Signal, and is not one of the statutory Signals of Distress referred to in Section 434 (2) of the Merchant Shipping Act, 1894, which provides that "If a master of a vessel uses or displays, or causes or permits any person under his authority to use or display, any of those signals of distress, except in the case of a vessel being in distress, he shall be liable to pay compensation for any labour undertaken, risk incurred, or loss sustained in consequence of that signal having been supposed to be a signal of distress, and that compensation may without prejudice to any other remedy, be recovered in the same manner in which salvage is recoverable."

## ALPHABETICAL (SPELLING) SIGNALS.

Under the arrangement explained below, every flag hoisted after Alphabetical Signal No. 1 has been made, and until Alphabetical Signal No. 3, or Numeral Signal No. 1 (*see page* 400) is made, represents the letter of the alphabet which has been allotted to it in the Code. As each of the 26 letters of the alphabet is now represented by a flag, any word can be spelt by this system.

If the word to be spelt consists of more than four letters, two or more hoists must be used, as no hoist is to contain more than four flags, and, if any letter occurs more than once in the word, this letter must on its second occurrence begin or be in a second hoist, and on its third occurrence must begin or be in a third hoist.

The following are the signals to be used :—

| Signal. | Meaning. |
|---|---|
| Code Flag over Flag E | **Alphabetical Signal No. 1**, indicating that the flags hoisted after it, until Alphabetical Signal No. 3 or Numeral Signal No. 1 is made, do not represent the signals in the Code, but are to be understood as having their alphabetical meanings and express individual letters of the alphabet which are to form words. |
| ,, F | **Alphabetical Signal No. 2**, indicating the end of a word made by Alphabetical Signals, or dot between initials. |
| ,, G | **Alphabetical Signal No. 3**, indicating that the Alphabetical Signals are ended; the signals which follow are to be looked out in the Code in the usual manner. |

### EXAMPLE :—

To Spell—William J. Perry.

1st hoist, Code Flag over **E** = *The signals which follow are alphabetical.*

2nd hoist, **WIL**
3rd hoist, **LIAM** } = *William.*

4th hoist, Code Flag over **F** = *End of the word (also means dot between initials).*

5th hoist, **J** = *J.*

6th hoist, Code Flag over **F** = *Dot between initials (also means end of the word).*

7th hoist, **PER**
8th hoist, **RY** } = *Perry.*

9th hoist, Code Flag over **G** = *Alphabetical Signals are ended.*

## NUMERAL SIGNALS.

Under the arrangement shown below, every flag hoisted after Numeral Signal No. 1 has been made, and until Numeral Signal No. 3 or Alphabetical Signal No. 1 (*see page* 398) has been made, represents one or more figures, as indicated in the Numeral Table below.

If the number to be signalled consists of more than four figures, two or more hoists must be used, as no hoist is to contain more than four flags ; and if any figure occurs more than once in the same number, the figure must on its second occurrence begin or be in a second hoist, and on its third occurrence it must begin or be in a third hoist, unless use can be made of the signals K to Z in the Numeral Table below.

The following are the signals to be used :—

| Signal. | Meaning. |
|---|---|
| Code Flag over Flag M | **Numeral Signal No. 1,** indicating that the flags hoisted after it, until Numeral Signal No. 3 or Alphabetical Signal No. 1 is made, do not represent the signals in the Code, but express figures, as indicated in the Numeral Table below, and have the special numerical values there given to them. |
| ,, N | **Numeral Signal No. 2.** indicating the Decimal Point. |
| ,, O | **Numeral Signal No. 3,** indicating that the Numeral Signals are ended ; the signals which follow are to be looked out in the Code in the usual manner. |

| Numeral Table. | Examples. |
|---|---|
| A . . 1<br>B . . 2<br>C . . 3<br>D . . 4<br>E . . 5<br>F . . 6<br>G . . 7<br>H . . 8<br>I . . 9<br>J . . 10<br>K . . 11<br>L . . 22<br>M . . 33<br>N . . 44<br>O . . 55<br>P . . 66<br>Q . . 77<br>R . . 88<br>S . . 99<br>T . . 100<br>U . . 0<br>V . . 00<br>W . . 000<br>X . . 0000<br>Y . . 00000<br>Z . . 000000 | To make 78865<br>1st hoist, Code Flag over **M** = { *The signals which follow are Numeral Signals, and are to be looked out in the Numeral Table.*<br>2nd hoist, **GRFE** . . . . = 78865<br>3rd hoist, Code Flag over **O** . = *The Numeral Signals are ended.*<br><br>To make 787<br>1st hoist, Code Flag over **M** = { *The signals which follow are Numeral Signals, and are to be looked out in the Numeral Table.*<br>2nd hoist, **GH** . . . . 78<br>3rd hoist, **G** . . . . 7 } = 787<br>4th hoist, Code Flag over **O** . = *The Numeral Signals are ended.*<br><br>To make 9·99876<br>1st hoist, Code Flag over M = { *The signals which follow are Numeral Signals, and are to be looked out in the Numeral Table.*<br>2nd hoist, **I** . . . . . = 9<br>3rd hoist, Code Flag over **N** . = *Decimal point*<br>4th hoist, **SHGF** . . . . = 99876 } 9·99876<br>5th hoist, Code Flag over **O** . = *The Numeral Signals are ended.* |

## SIGNALS MADE BY ONE FLAG.

### To be used only between Vessels Towing and being Towed.

**The Flag is to be held in the hand, and only to be shown just above the Gunwale.**

| Signals about. | Flag. | Meaning when Made | |
|---|---|---|---|
| | | By the Ship Towed. | By the Ship Towing. |
| Cables, *or*, Hawsers. | A | —Is the towing cable (*or*, hawser) fast? | Is the towing cable (*or*, hawser) fast? |
| | B | —The towing cable (*or*, hawser) is fast. | The towing cable (*or*, hawser) is fast. |
| | C | —The towing cable (*or*, hawser) is not fast. | The towing cable (*or*, hawser) is not fast. |
| | D | —Equalise the strain on the cables (*or*, hawsers). | Equalise the strain on the cables (*or*, hawsers). |
| | E | —Cannot slack more cable (*or*, hawser). | Cannot slack more cable (*or*, hawser). |
| | F | —Shorten in the port cable (*or*, hawser). | Shorten in the port cable (*or*, hawser). |
| | G | —Shorten in the starboard cable (*or*, hawser). | Shorten in the starboard cable (*or*, hawser). |
| | H | —Shorten in both cables (*or*, hawsers). | Shorten in both cables (*or*, hawsers). |
| | I | —Veer the port cable (*or*, hawser). | Veer the port cable (*or*, hawser). |
| | J | —Veer the starboard cable (*or*, hawser). | Veer the starboard cable (*or*, hawser). |
| | K | —Veer both cables (*or*, hawsers). | Veer both cables (*or*, hawsers). |
| | L | —Cast off the port hawser. | Cast off the port hawser. |
| | M | —Cast off the starboard hawser. | Cast off the starboard hawser. |
| | N | —Cast off both hawsers. | Cast off both hawsers. |
| Speed. | O | —Go as slow as possible. | Am going as slow as possible. |
| | P | —Go easy. | Am going easy. |
| | Q | —Go half speed. | Am going half speed. |
| | R | —Go full speed. | Am going full speed. |
| | S | —Stop the engines. | Must stop. |
| Steering. | T | —Steer more to port. | Steer more to port. |
| | U | —Steer more to starboard. | Steer more to starboard. |
| | V | —Steady as you go. | Steady as you go. |
| | W | —Steer six points from the wind. | Ship will not steer properly. |
| Sail. | X | —Make sail. | Make sail. |
| | Y | —Set fore and aft sails. | Set fore and aft sails. |
| Special. | Z | —Man overboard. | Man overboard. |

## SIGNALS BY NIGHT.

To be used only between ships towing and being towed, and to be made by short flashes of light.

Steer more to port — — | Steer more to starboard —

Cast off hawsers — — — —

# URGENT AND IMPORTANT SIGNALS.

## Two-Flag Signals.

### CODE FLAG OVER ONE FLAG.

| Signal. | Meaning. |
|---|---|
| Code Flag over A | —I am on full speed trial. |
| ,, ,, ,, B | —I am taking in (*or*, discharging) gunpowder or other explosive. |
| ,, ,, ,, C | —Yes, *or*, Affirmative. |
| ,, ,, ,, D | —No, *or*, Negative. |
| ,, ,, ,, E | —Alphabetical Signal No. 1.* |
| ,, ,, ,, F | —Alphabetical Signal No. 2.* |
| ,, ,, ,, G | —Alphabetical Signal No. 3.* |
| ,, ,, ,, H | —Stop, Heave-to, *or*, Come nearer; I have something important to communicate. |
| ,, ,, ,, I | —I have not a clean bill of health. |
| ,, ,, ,, J | —I have head-way. |
| ,, ,, ,, K | —I have stern-way. |
| ,, ,, ,, L | —I have (*or*, have had) some dangerous infectious disease on board. |
| ,, ,, ,, M | —Numeral Signal No. 1.† |
| ,, ,, ,, N | —Numeral Signal No. 2.† |
| ,, ,, ,, O | —Numeral Signal No. 3.† |
| ,, ,, ,, P | —I am about to sail. |
| ,, ,, ,, Q | —I have a clean bill of health, but am liable to quarantine. |
| ,, ,, ,, R | —Do not pass ahead of me. |
| ,, ,, ,, S | —I want a pilot. |
| ,, ,, ,, T | —Do not overtake me. |
| ,, ,, ,, U | —My engines are stopped. |
| ,, ,, ,, V | —My engines are going astern. |
| ,, ,, ,, W | —All boats are to return to the ship. |
| ,, ,, ,, X | —I will pass ahead of you. |
| ,, ,, ,, Y | —All ships of the convoy are to rejoin company. |
| ,, ,, ,, Z | —I will pass astern of you. |

* *For instructions as to the use of these Signals, see page 399.*

† *For instructions as to the use of these Signals, see page 400.*

## DISTRESS SIGNALS.

The *chief* Distress Signal is the same as in the Old Code, namely, NC, which signifies "In distress. Want immediate assistance."

The following are amongst the more important of the other Distress Signals, which will be found under the heading "DISTRESS," at page 14 of Signal Book.

NA Aground. Want immediate assistance.

NF Dying for want of Water.

NH Fire, *or* Leak. Want immediate assistance.

NV Short of Provisions. Starving.

OTHER IMPORTANT URGENT SIGNALS ARE—

AM Accident. Want a Surgeon.

MN Stop instantly.

JD You are standing into danger *(same as Old Code).*

PT Want a pilot *(same as Old Code).*

DC We are coming to your assistance.

CP Cannot assist.

THE FOUR SPECIAL DISTANT SIGNALS, MADE BY A BALL AND CONE, ARE—

| | | | |
|---|---|---|---|
| You are running into danger. | Fire, *or* Leak. Want immediate assistance. | Short of Provisions. Starving. | Aground. Want immediate assistance. |

THE CARDINAL POINTS OF THE COMPASS ARE—

AQD North. AQU East.

ARL South. ASD West.

*(These are Compass bearings).*

# SEMAPHORE SIGNS & SIGNIFICATIONS.

| | | | | |
|---|---|---|---|---|
| ALPHABETICAL | NUMERAL | ANNUL | REPEATED THREE TIMES IN QUICK SUCCESSION FULL STOP (AAA) | A & I |
| B & 2 | C & 3 | D & 4 | E & 5 | F & 6 |
| G & 7 | H & 8 | I & 9 | J & ALPHABETICAL | K & N° O |
| L | M | N | O | P |
| Q | R | S | T | U |
| V | W | X | Y | Z |

# INSTRUCTIONS FOR THE USE OF THE SEMAPHORE.

Should one of His Majesty's ships wish to communicate by semaphore with a British merchant vessel, she will hoist the Red Ensign where best seen, and J flag in any position inferior to it, keeping them flying while making the message, and hauling them down on its completion.

Should a British merchant vessel wish to communicate by semaphore with one of His Majesty's ships, with another British merchant vessel, or with a Signal Station, she will hoist J flag alone where it may best be seen, and keep it flying while making the message, hauling it down on completion.

If there should be more than one vessel within signalling distance, the vessel addressed may be indicated as in flag signalling.

### Precaution when His Majesty's Ships are cruising in company.

When men-of-war are cruising in company, it is very probable that frequent semaphore messages will be passing between the Senior Officer's ship and the remainder.

As International Code Flag "J" is also used by His Majesty's ships for semaphoring among themselves, merchant vessels should bear in mind that they are only addressed when one of His Majesty's ships hoists the Red Ensign.

In order to prevent possible confusion the Senior Officer of His Majesty's ships cruising in company will probably, in order to leave his ship free to signal at a moment's notice with any of the ships under his command, detail off some ship (other than the one he is in) to deal with signalling which may be necessary between His Majesty's ships and merchant vessels.

### To Exercise Semaphore Signalling.

A semaphore signal may be made with the Naval mechanical semaphore or with small flags held in the hands. In either case it is very important that the sender should make certain that he has a good background.

As by far the best background is that afforded by the sky or sea, the sender should place himself in such a position where these conditions obtain. It is practically useless to semaphore against the upper works of a ship (unless the distance between the ships communicating is very close) as the position of the sender's arms are not sufficiently in relief in comparison with the dark or neutral surroundings afforded by objects immediately behind the sender. The best hand flags to use are small letter "O" flags, 18″ or 22″ square mounted on sticks projecting below the flag the same number of inches.

The indicator in the Naval mechanical semaphore indicates from which side the signs and letters are to be read, and when closed indicates that the communication is finished.

A person wishing to signal will put his arms up to the alphabetical sign (*see* plate), and wait until the person to whom the signal is to be made hoists his Answering pendant (Code flag) close up.

He then will proceed with the message by spelling, making a momentary pause between each sign or letter. The arms are to be dropped between the words or groups.

Should the Answering pendant be dipped by the person receiving the signal, the sender will repeat, slowly, the last part of the message made before the pendant was dipped till the receiver hoists the Answering pendant close up.

When it is required to semaphore a message which contains figures it will, in nearly all cases, be found far less liable to error if they are spelt out; but they may, however, be signalled by putting the arms up to the Numeral sign (*see* plate) and then making the numbers. When the signalling of figure signs has finished, and it is desired to resume spelling, the alphabetical sign should be made again to signify that the signs which follow are to be read as letters.

### How to Answer and Receive a Signal made by Semaphore.

The Answering pendant is to be hoisted at the dip when it is seen that a ship or signal station, by hoisting the J flag, wishes to communicate by semaphore, and close up when the receiver is ready to read and write down the message.

It is to be dipped when a word is lost; the sender then to repeat slowly the last part of the message made until the Answering pendant is hoisted close up again.

One of His Majesty's ships taking in a semaphore signal from a British merchant vessel will hoist the Red Ensign where best seen, and keep it flying close up while the signal is being made, as well as answering the signal with the Code flag (Answering pendant).

# FLASHING SIGNALS.

## The Morse Code.

In flashing, the Morse symbols are expressed by two elements called a *Dot* and a *Dash*. These are used singly as in letters "E" (- one *dot*) and "T" (— one *dash*), or in combination, as in letters "L" (- — - -) or "A" (- —).

These symbols can be conveyed by several different means such as waving a flag through short and long arcs, or short and long exposures of light, or by short or long blasts on the siren, steam whistle, or fog horn.

For flashing *at a moderate rate*, the *dots*, *dashes*, and *spaces*, between them, should be made to bear the following ratio one to another in their relative duration of time:—

A dot is taken as the unit, and
A dash is equivalent to three units.

The space of time—
Between any two elements of a letter or sign is equal to one unit.
Between two complete letters or signs is equal to three units.
Between two words or groups is equal to six units.

In the International Code Signal Book it is arbitrarily laid down that the unit of time (for a *dot* or *short* flash) is one second. This, however, is obviously only intended as a guide for abnormally slow sending, as it would be absurd to restrict a man to a rate of only 1·4 words a minute (which a unit rate of one second works out to) if he was well capable of flashing *correctly* at the rate of six or more words a minute.

Although the rules prescribed above have been found most suitable for skilled signalmen, experience has proved that a slight modification is beneficial when flashing has, of necessity, to be made at comparatively slow rates. It is then best—while generally obeying the rules—to err on the side of making the dots rather shorter than their prescribed proportion to the dashes. In fact it hardly matters how short the dot is, as long as it can clearly be seen, but if the dashes are prolonged over their proportionate length, the distinction between a dot and a dash becomes comparatively all the greater.

Again, should the receiving signalman not be a skilled signalman, it is better to allow him a longer pause between the letters than three units, taking care, of course, to proportionately prolong the space between two words or groups.

## The Morse Symbols.

Below are shown the Morse Alphabetical Signs, which in no case consist of more than four elements. The general principle underlying the composition of these signs is that those letters which occur most frequently in ordinary English prose are given the shortest symbols. Thus, for every time the letter "Q" (the Morse symbol for which is — — - — 13 units) appears in ordinary English Composition, the letter "E" (the Morse symbol for which is - one unit) appears about 140 times.

### Morse Alphabet.

| | | | |
|---|---|---|---|
| A | • — | N | — • |
| B | — • • • | O | — — — |
| C | — • — • | P | • — — • |
| D | — • • | Q | — — • — |
| E | • | R | • — • |
| F | • • — • | S | • • • |
| G | — — • | T | — |
| H | • • • • | U | • • — |
| I | • • | V | • • • — |
| J | • — — — | W | • — — |
| K | — • — | X | — • • — |
| L | • — • • | Y | — • — — |
| M | — — | Z | — — • • |

### Numerals.

The following are the Morse Symbols for Figures, which, if used, should be preceded by the Numerical Sign (- - — - - -).

1. • — — — —
2. • • — — —
3. • • • — —
4. • • • • —
5. • • • • •
6. — • • • •
7. — — • • •
8. — — — • •
9. — — — — •
0. — — — — —

From the above, it will be observed that the symbols for figures always conform to the following rules :—

(*a*) They invariably consist of five elements—dots or dashes.

(*b*) Dots and dashes are not sandwiched ; the sign either begins with one or more dots or with one or more dashes.

Thus, when figures are signalled, the receiver can check the number by either the number of dots or dashes composing the signs ; up to 5 the figure can be arrived at by the number of dots the sign commences with, or by subtracting the number of

concluding dashes from 5 ; from 6 to 0 inclusive the figure can be checked by either adding five to the number of commencing dashes, or subtracting (except in the case of 0) the number of concluding dots from 10.

*Caution against Numerals.*

In practice, however it is found that the signalling of Numerals is likely to cause errors, and so it is far better (as it probably saves time and trouble in the end) when numbers occur to spell them out.

## SINGLE LETTER SIGNALS MADE BY FLASHING.

The following letters, when flashed singly and repeated at intervals, without any preceding sign, are contained in the International Code Signal Book, and have urgent meanings :—

| | | |
|---|---|---|
| U | • • — | You are standing into danger. |
| V | • • • — | I want assistance, remain by me. |
| W | • — — | Have encountered ice. |
| P | • — — • | Your lights are out, or want trimming. |
| R | • — • | The way is off my ship, you may feel your way past me. |
| L | • — • • | Stop, or heave to, I have something important to communicate. |
| F | • • — • | Am disabled, communicate with me. |

## PROCEDURE OF ANSWERING THE SEARCHLIGHT BY DAYLIGHT.

In the event of one of His Majesty's ships calling up a merchant ship or signal station in *Daylight* by means of the Searchlight (a method which may be employed when distance renders it impracticable to read flags or semaphore), the merchant ship or signal station should use the Answering pendant (Code flag) in the following manner :—

To be hoisted at the "dip" when the call is observed, and close up when ready to read the signals which will follow. To be dipped when a word or group is missed ; the man-of-war will then repeat slowly the last part of the message made, until the Answering pendant is hoisted close up again.

## SIGNALLING BY FLAG WAVING.

Semaphore signals have the great advantage that each sign is made in its entirety, and, as long as the relative position of the sender's arms can be clearly discerned, it is easy to read the letters at a good rate. A disadvantage incidental to the system is, however, that as each sign is a fixed signal it requires a background which will afford sufficient relief to the arms to enable the signs to be made out at any distance.

Sometimes conditions may obtain where flag signalling is impracticable, and when the background is so close or dark that the relative position of the sender's arms in semaphoring cannot be distinguished.

Such conditions may obtain when, for instance, it is desirable to signal off to a ship from the shore where a good background is unobtainable. It is then that flag-waving may be profitably employed. This results from the fact that an object in motion, such as a white handkerchief or flag waved, is naturally far more attractive for calling up, and more conspicuous for seeing, than some stationary sign as with semaphore.

The more remarkable the contrast is between the colour of the flag used and the background, the better able is the receiver to make out the signal. Consequently, Morse flags are generally made of two colours, all blue, or white with a narrow blue horizontal bar, so that the one which is likely to show up best can be selected. The sender must consider the background he affords from the direction of signalling, and, all according to whether he presents himself against a dark or light background, he should use the flag of the opposite colour. The position of the sun must also be considered. As a general rule, if the sun is in front of the sender a white flag will be found most conspicuous ; if the sun is behind the sender (unless the sender is himself in shadow), a blue flag would be found best.

The Morse flags mentioned above can be obtained in two sizes—three feet square and two feet square. The staffs are five feet six inches and three feet six inches long respectively.

*Board of Trade Instructions for the guidance of Masters and Seamen when using the Mortar and Rocket apparatus for saving life.*

In the event of your vessel stranding within a short distance of the United Kingdom, and the lives of the crew being placed in danger, assistance will, if possible, be rendered from the shore in the following manner, namely—

1. A rocket or shot with a thin line attached will be fired across your vessel. Get hold of this line as soon as you can, and when you have secured it, let one of the crew be separated from the rest, and, if in the day time, wave his hat or hand, or a flag or handkerchief; or if at night, let a rocket or blue light or a gun be fired, or let a light be displayed over the side of the ship and be again concealed, as a signal to those on shore.

2. When you see one of the men on shore separated from the rest wave a RED flag, or (if at night) show a RED light, and then conceal it, you are to haul upon the rocket line until you get a tailed block with an endless fall rove through it.

3. Make the tail of the block fast to the mast about 16 feet above the deck, or, if your masts are gone, to the *highest secure* part of the vessel. When the tail block is made fast, and the rocket line unbent from the whip, let one of the crew, separated from the rest, make the signal required by article 1 above.

NOTE.—The tail block being fitted with a swivel, will enable you to take out any turns in the endless fall without unbending the block.

4. As soon as the signal is seen on shore, a hawser will be bent to the whip line, and will be hauled off to the ship by those on shore.

5. When the hawser is got on board, the crew should at once make it fast to the same part of the ship as the tailed block is made fast to, only about 18 inches higher, taking care that there are no turns of the whip line round the hawser.

NOTE.—The turns can be prevented by bringing the end of the hawser up between the two parts of the endless fall.

6. When the hawser has been made fast on board, the signal directed to be made in Article 1 above is to be repeated.

7. The men on shore will then pull the hawser taut, and by means of the whip line will haul off to the ship a sling life buoy, into which the person to be hauled ashore is to get, and be made fast. When he is in and secured, one of the crew must be separated from the rest, and again signal to the shore as directed in Article 1 above. The people on shore will then haul the person in the sling to the shore,

and when he has landed, will haul back the sling to the ship for others. This operation will be repeated until all persons are hauled ashore from the wrecked vessel.

8. It may sometimes happen that the state of the weather and the condition of the ship will not admit of a hawser being set up; in such cases a sling or life-buoy will be hauled off instead, and the ship-wrecked persons will be hauled through the surf, instead of along a hawser.

Masters and crews of stranded vessels should bear in mind that SUCCESS in landing them in a great measure DEPENDS UPON THEIR COOLNESS AND ATTENTION TO THE RULES HERE LAID DOWN; and that by attending to them many lives are annually saved by the mortar and rocket apparatus on the coasts of the United Kingdom.

The system of signalling must be strictly adhered to; and all women, children, passengers, and helpless persons should be landed before the crew of the ship.

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SECTION LI.

## TO MEASURE A HOLD.

To measure a compartment of a vessel's hold between two thwartship bulkheads.

Take the full length.

For lengths of 50 feet and under, divide the length into 4 equal parts.

Lengths above 50 feet divide into 6 equal parts.

Take depths, at each of these divisions and at both the extreme ends, from the under side of the deck to the ceiling close to the keelson; deduct from each depth one-third of the round of the beam.

If the depth in the middle of the compartment does not exceed 16 feet, divide these depths into 4 equal parts. If the middle depth is over 16 feet divide them into 6 equal parts.

At each point of division of the depths, and at the upper point also, take the horizontal breadth of the vessel to the inner surface of the cargo battens, and at the lower point to the inner surface of the ceiling, but this lower breadth must be taken as a fair average

breadth to come at a correct result. Thus in the diagram *(Plate No. 159)*, though *A B* is the bottom horizontal breadth (being the only

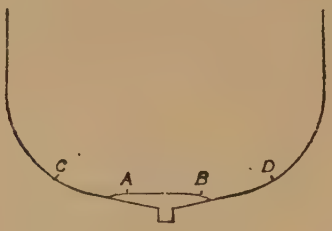


*Plate No. 159.*

flat part), it will not give the cubic contents correctly, and the fair place to measure the bottom breadth will be from about *C* to *D*.

These measurements being all taken, proceed to calculate the cubic contents by the method at page 415 (2) and (3).

To measure a compartment at the extreme end of a vessel proceed in the same way, but note that the *end* point will have no breadths to be measured, being a point only. Thus in this diagram of a vessel's after-hold *(Plate No. 160)*, suppose the length from *A* to *B* is 40 feet; divide it into 4 parts of 10 feet each. The divisional points will come

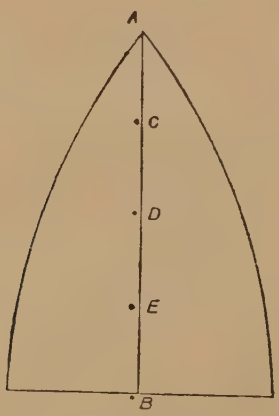


*Plate No. 160.*

at *C D E*. At these points, and also at *B*, the necessary depths and breadths must be taken, but *A* being merely the point at the end of the hold, has no value, and no depths or breadths are required here.

*Plate No. 161* may be taken to represent the section of the hold at point *C* of the other diagram. Now supposing the depth of the compartment, from $\frac{1}{3}$ the round of beam below the deck shown by point *A*, to the top of the ceiling at point *B*, is 12 feet, divide this by 4 and take breadths as shown at *C*, *D*, *E*, *F*, and *G*. Then proceed with the calculation as in the other case.

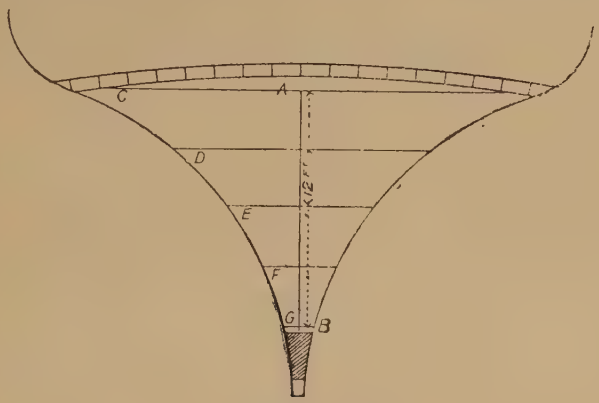


*Plate No. 161.*

To measure a compartment in the 'tween decks it will be sufficient, unless at the extreme end, to take the length, mean breadth at half the height, and the mean height; multiply the three together, and the result will be the cubic contents.

If at the extreme bow or stern, proceed by the rule at page 416 (4).

The principal measurements of a ship are :—The Gross Tonnage, the Registered Tonnage, and the Under Deck Tonnage.

The Gross Tonnage is, nearly, the entire cubic capacity of the ship, taking in deck-houses and erections of all kinds, in tons of 100 cubic feet.

The Under Deck Tonnage is the cubic capacity (in tons of 100 cubic feet) of the ship below the tonnage deck (see page 414, § 20).

The Register Tonnage is that on which the ship pays dues, and is the gross tonnage less deductions on account of crew space and engine space.

Engine space is allowed for according to the rules in the M. S. Act (see page 416, § 23).

Crew space is allowed according to the rule on page 420.

Displacement Tonnage is, as explained in another chapter, the total weight, in tons, of ship and everything on board as she floats at any particular time.

Deadweight Tonnage is the ship's carrying capacity, in other words, the actual weight in tons which she will carry of deadweight cargo, such as coal, iron ore, &c., including bunker coal. In former days it was thought a vessel did well if she carried $1\frac{1}{2}$ times her under deck tonnage in deadweight cargo; but some of the new steel cargo steamers of the present day will carry $1\frac{1}{2}$ times their gross tonnage, and, consequent on deductions and allowances of various kinds, in some cases $2\frac{3}{4}$ times their Register Tonnage.

The Registered Length of a vessel is that from the fore side of the foremost part of the stem to the after side of the stern post (the after post in screw steamers).

The Registered Breadth is the greatest breadth from the outside of plate or plank on one side, to the outside of the plate or plank on the other side.

The Registered Depth is the *midship* depth from the top of the beams to the top of the floors, or, if there is a ceiling, to the top of the ceiling.

The legal tonnage of ships is measured by the rules in the M. S. Act, which are here given for reference; but, as this is always done by government surveyors, it is a duty that will not fall to the young seaman. At the same time it is often necessary to measure a hold, to ascertain what amount of cargo it will take, and the rules already given will, if followed, enable the young officer to do this.

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## RULES OF MEASUREMENT FOR TONNAGE.

20. Throughout the following rules, the tonnage deck shall be taken to be the upper deck in ships which have less than three decks, and to be the second deck from below in all other ships; and in carrying such rules into effect, all measurements shall be taken in feet and fractions of feet, and all fractions of feet shall be expressed in decimals.

21. The tonnage of every ship to be registered, with the exceptions mentioned in the next section, shall, previously to her being registered, be ascertained by the following rule, called Rule 1; and the tonnage of every ship to which such rule can be applied, whether she is about to be registered or not, shall be ascertained by the same rule:—

(1.) Measure the length of the ship in a straight line along the upper side of the tonnage deck from the inside of the inner plank (average thickness) at the side of the stem to the inside of the midship stern timber or plank there, as the case may be (average thickness), deducting from this length what is due to the rake of the

bow in the thickness of the deck, and what is due to the rake of the stern timber in the thickness of the deck, and also what is due to the rake of the stern timber in one-third of the round of the beam; divide the length so taken into the number of equal parts required by the following table, according to the class in such table to which the ship belongs:—

TABLE.

Class 1. Ships of which the tonnage deck is, according to the above measurement, 50 feet long or under, into 4 equal parts:

Class 2. Ships of which the tonnage deck is, according to the above measurement, 50 feet long, and not exceeding 120, into 6 equal parts:

Class 3. Ships of which the tonnage deck is, according to the above measurement, above 120 feet long, and not exceeding 180, into 8 equal parts:

Class 4. Ships of which the tonnage deck is, according to the above measurement, above 180 feet long, and not exceeding 225, into 10 equal parts:

Class 5. Ships of which the tonnage deck is, according to the above measurement, above 225 feet long, into 12 equal parts:

(2.) Then the hold being first sufficiently cleared to admit of the required depths and breadths being properly taken, find the transverse area of such ship at each point of division of the length as follows:—Measure the depth at each point of division, from a point at a distance of one-third of the round of the beam below such deck, or, in case of a break, below a line stretched in continuation thereof, to the upper side of the floor timber at the inside of the limber strake, after deducting the average thickness of the ceiling which is between the bilge planks and limber strake; then if the depth at the midship division of the length do not exceed sixteen feet, divide each depth into four equal parts; then measure the inside horizontal breadth at each of the three points of division, and also at the upper and lower points of the depth, extending each measurement to the average thickness of that part of the ceiling which is between the points of measurement; number these breadths from above (*i.e.*, numbering the upper breadth one, and so on down to the lowest breadth); multiply the second and fourth by four, and the third by two; add these products together, and to the sum add the first breadth and the fifth; multiply the quantity thus obtained by one-third of the common interval between the breadths, and the product shall be deemed the transverse area; but if the midship depth exceed sixteen feet, divide each depth into six equal parts instead of four, and measure, as before directed, the horizontal breadths at the five points of division, and also at the upper and lower points of the depth, number them from above as before; multiply the second, fourth, and sixth by four, and the third and fifth by two; add these products together, and to the sum add the first breadth and the seventh; multiply the quantity thus obtained by one-third of the common interval between the breadths, and the product shall be deemed the transverse area.

(3.) Having thus ascertained the transverse area at each point of division of the length of the ship as required by the above table, proceed to ascertain the register tonnage of the ship in the following manner:—Number the areas successively 1, 2, 3, &c., No. 1 being at the extreme limit of the length of the bow, and the last No. at the extreme limit of the length of the stern; then, whether the length be divided, according to the table, into four or twelve parts, as in classes 1 and 5, or any intermediate number, as in classes 2, 3, and 4, multiply the second and every even numbered area by four, and the third and every odd numbered area (except the first

and last) by two; add these products together, and to the sum add the first and last if they yield anything; multiply the quantity thus obtained by one-third of the common interval between the areas, and the product will be the cubical contents of the space under the tonnage deck; divide this product by one hundred, and the quotient being the tonnage under the tonnage deck, shall be deemed to be the register tonnage of the ship, subject to the additions and deductions hereinafter mentioned.

(4.) If there be a break, a poop, or any other permanent closed-in space on the upper deck, available for cargo or stores, or for the berthing or accommodation of passengers or crew, the tonnage of such space shall be ascertained as follows:—Measure the internal mean length of such space in feet, and divide it into two equal parts; measure at the middle of its height three inside breadths, namely, one at each end and the other at the middle of the length; then to the sum of the end breadths add four times the middle breadth, and multiply the whole sum by one-third of the common interval between the breadths; the product will give the mean horizontal area of such space; then measure the mean height, and multiply by it the mean horizontal area; divide the product by one hundred, and the quotient shall be deemed to be the tonnage of such space, and shall be added to the tonnage under the tonnage deck, ascertained as aforesaid, subject to the following proviso—that nothing shall be added in respect of any building erected for the shelter of deck passengers, and approved by the Board of Trade.

(5.) If the ship has a third deck, commonly called a spar deck, the tonnage of the space between it and the tonnage deck shall be ascertained as follows:—Measure in feet the inside length of the space at the middle of its height from the plank at the side of the stem to the lining on the timbers at the stern, and divide the length into the same number of equal parts into which the length of the tonnage deck is divided as above directed; measure (also at the middle of its height) the inside breadth of the space at each of the points of division, also the breadth at the stem and the breadth at the stern; number them successively 1, 2, 3, &c., commencing at the stem; multiply the second and all the other even numbered breadths by four, and the third and all the other odd numbered breadths (except the first and last) by two; to the sum of these products, add the first and last breadths; multiply the whole sum by one-third of the common interval between the breadths, and the result will give in superficial feet the mean horizontal area of such space; measure the mean height of such space, and multiply by it the mean horizontal area, and the product will be the cubical contents of the space; divide this product by one hundred, and the quotient shall be deemed to be the tonnage of such space, and shall be added to the other tonnage of the ship ascertained as aforesaid; and if the ship has more than three decks, the tonnage of each space between decks above the tonnage deck shall be severally ascertained in manner above described, and shall be added to the tonnage of the ship ascertained as aforesaid.

§ 23. In every ship propelled by steam or other power requiring engine room, an allowance shall be made for the space occupied by the propelling power, and the amount so allowed shall be deducted from the gross tonnage of the ship, ascertained as aforesaid, and the remainder shall be deemed to be the register tonnage of such ship; and such deduction shall be estimated as follows:

(*a.*) As regards ships propelled by paddle wheels, in which the tonnage of the space solely occupied by and necessary for the proper working of the boilers and

machinery is above twenty per cent. and under thirty per cent. of the gross tonnage of the ship, such deduction shall be thirty-seven one-hundredths of such gross tonnage; and in ships propelled by screws, in which the tonnage of such space is above thirteen per cent. and under twenty per cent. of such gross tonnage, such deduction shall be thirty-two one-hundredths of such gross tonnage.

(*b.*) As regards all other ships, the deduction shall, if the Commissioners of Customs and the Owner both agree thereto, be estimated in the same manner; but either they or he may, in their or his discretion, require the space to be measured and the deduction estimated accordingly; and whenever such measurement is so required, the deduction shall consist of the tonnage of the space actually occupied by, or required to be enclosed for, the proper working of the boilers and machinery, with the addition, in the case of ships propelled by paddle wheels, of one-half, and in case of ships propelled by screws, of three-fourths of the tonnage of such space; and the measurement and use of such space shall be governed by the following rules:

(1.) Measure the mean depth of the space from its crown to the ceiling at the limber strake, measure also three, or, if necessary, more than three breadths of the space at the middle of its depth, taking one of such measurements at each end, and another at the midde of the length; take the mean of such breadths; measure also the mean length of the space between the foremost and aftermost bulkheads or limits of its length, excluding such parts, if any, as are not actually occupied by, or required for, the proper working of the machinery; multiply together these three dimensions of length, breadth, and depth, and the product will be the cubical contents of the space below the crown; then find the cubical contents of the space or spaces, if any, above the crown aforesaid, which are framed in for the machinery or for the admission of light and air, by multiplying together the length, depth, and breadth thereof; add such contents to the cubical contents of the space below the crown; divide the sum by one hundred, and the result shall be deemed to be the tonnage of the said space.

(2.) If in any ship in which the space aforesaid is to be measured, the engines and boilers are fitted in separate compartments, the contents of each shall be measured severally in like manner, according to the above rules, and the sum of their several results shall be deemed to be the tonnage of the said space:

(3.) In the case of screw steamers, in which the space aforesaid is to be measured, the contents of the shaft trunk shall be added to, and deemed to form part of, such space, and shall be ascertained by multiplying together the mean length, breadth, and depth of the trunk, and dividing the product by one hundred:

(4.) If in any ship in which the space aforesaid is to be measured, any alteration be made in the length or capacity of such space, or if any cabins be fitted in such space, such ship shall be deemed to be a ship not registered until remeasurement:

(5.) If any ship in which the space aforesaid is to be measured, any goods or stores are stowed or carried in such space, the Master and Owner shall each be liable to a penalty not exceeding £100.

1. *Amendment of Rules for Measurement of Tonnage.*—(1.) In the measurement of a ship for the purpose of ascertaining her register tonnage, no deduction shall be allowed in respect of any space which has not been first included in the measurement of her tonnage.

(2.) 17 & 18 *Vict.*, *c.* 104.—In section twenty-one, paragraph (4), of the Merchant Shipping Act, 1854, the words "First, that nothing shall be added for a closed-in space solely appropriated to the berthing of the crew, unless such space exceeds one twentieth of the remaining tonnage of the ship, and in case of such excess the excess only shall be added"; and secondly, in section twenty-two, paragraph (2), of the same Act, the words "subject to the deduction for a closed-in space appropriated to the crew, as mentioned in Rule I." shall be repealed.

Provided that this section shall not apply until after the expiration of five years from the date of the passing of this Act to any ship in the measurement or re-measurement of which the deductions prohibited by this section have been made before the tenth day of March, one thousand eight hundred and eighty-nine, or to any ship the building of which was commenced before the tenth day of March, one thousand eight hundred and eighty-nine, and which is registered for the first time between that date and the last day of December, one thousand eight hundred and eighty-nine, unless in either case the ship is, before the expiration of the said five years, measured or re-measured in accordance with the provisions of this Act, and any such ship may be measured or re-measured at the request of the owner.

But this exemption shall not extend to any ship in the case of which the allowance for propelling-power space exceeds fifty per cent. of the gross tonnage of the ship.

Subject as aforesaid, the tonnage of every ship shall be estimated for all purposes as if any deduction prohibited by this section had not been made, and the particulars relating to the ship's tonnage in the register book, and in her certificate of registry, shall be corrected accordingly.

2. *Rule as to allowance for Engine-room in Steamers.*—In the case of any ship built or measured after the passing of this Act, such portion of the space or spaces above the crown of the engine-room and above the upper deck as is framed in for the machinery or for the admission of light and air, shall not be included in the measurement of the space occupied by the propelling power, except in pursuance of a request in writing to the Board of Trade by the owner of the ship, and shall not be included in pursuance of such request unless—

(*a.*) that portion is first included in the measurement of the gross tonnage; and

(*b.*) a surveyor appointed under the Fourth Part of the Merchant Shipping Act, 1854, certifies that the portion so framed in is reasonable in extent and is so constructed as to be safe and seaworthy, and that it cannot be used for any purpose other than the machinery or for the admission of light and air to the machinery or boilers of the ship.

3. *Deductions for Navigation Spaces, &c.*—(1.) In measuring or re-measuring a ship for the purpose of ascertaining her register tonnage, the following deductions shall be made from the space included in the measurement of the tonnage; —

(*a.*) In the case of a ship wholly propelled by sails, any space set apart and used exclusively for the storage of sails:

(*b.*) In the case of any ship—

(i.) Any space used exclusively for the accommodation of the master;

(ii.) Any space used exclusively for the working of the helm, the capstan, and the anchor gear, or for keeping the charts, signals, and other instruments of navigation, and boatswain's stores; and

(iii.) The space occupied by the donkey engine and boiler, if connected with the main pumps of the ship.

(2.) The deductions allowed under this section shall be subject to the following provisions, namely:—

(*a.*) The space deducted must be certified by a surveyor appointed by the Board of Trade as reasonable in extent and properly and efficiently constructed for the purpose for which it is intended;

(*b.*) There must be permanently marked in or over every such space a notice stating the purpose to which it is to be applied, and that whilst so applied it is to be deducted from the tonnage of the ship;

(*c.*) The deduction on account of space for storage of sails must not exceed two and a-half per cent. of the tonnage of the ship.

4. *Provisions as to deductions in case of certain Steamships.*—In the case of a screw steamship which, at the passing of this Act, has an engine-room allowance of thirty-two per cent. of the gross tonnage of the ship, and in which any crew space on deck has not been included in the gross tonnage, whether its contents have been deducted therefrom or not, the crew space shall be, on the application of the owner of the ship, or by direction of the Board of Trade, measured and its contents ascertained and added to the register tonnage of the ship; and if it appears that with such addition to the tonnage the engine-room does not occupy more than thirteen per cent. of the tonnage of the ship, the existing allowance for engine-room of thirty-two per cent. of the tonnage shall be continued, notwithstanding anything in this Act.

5. *Measurement of Ships with double bottoms for water ballast.*—In the case of a ship constructed with a double bottom for water ballast, if the space between the inner and outer plating thereof is certified by a surveyor appointed by the Board of Trade to be not available for the carriage of cargo, stores, or fuel, then the depth required by section twenty-one, paragraph (2), of the Merchant Shipping Act, 1854, shall be taken to be the upper side of the inner plating of the double bottom, and that upper side shall, for the purposes of measurement, be deemed to represent the floor timber referred to in that section.

6. *Re-measurement of Foreign Ships.*—If and whenever it is made to appear to Her Majesty that the tonnage of any foreign ship, as measured by the rules of the country to which she belongs, materially differs from that which would be her tonnage if measured under the Merchant Shipping Act, and the Acts amending the same, Her Majesty may, from time to time, by Order in Council, direct that, notwithstanding any Order in Council for the time being in force under those Acts, any of the ships of that country may, for all or any of the purposes of those Acts, be re-measured in accordance with the provisions of those Acts, and Her Majesty may revoke any Order so made.

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NOTE.—Any space, other than a double bottom, adapted *only* for water ballast may now be deducted from the gross tonnage under certain conditions.

## CREW SPACES.

The following Rules shall be observed with respect to Accommodation on board *British* Ships; (that is to say,)

(1.) Every Place in any Ship occupied by Seamen or Apprentices, and appropriated to their Use, shall have for every such Seaman or Apprentice a Space of not less than Seventy-two Cubic Feet, and of not less than Twelve Superficial Feet, measured on the Deck or Floor of such Place:

(2.) Every such Place shall be such as to make the Space aforesaid available for the proper Accommodation of the Men who are to occupy it, shall be securely constructed, properly lighted and ventilated, properly protected from Weather and Sea, and as far as practicable properly shut off and protected from Effluvium which may be caused by Cargo or Bilge Water:

(3.) No such Place as aforesaid shall be deemed to be such as to authorize a Deduction from registered Tonnage, under the Provisions herein-after contained, unless there is or are in the Ship One or more properly constructed Privy or Privies for the Use of the Crew; such Privy or Privies to be of such Number and of such Construction as may be approved by the Surveyor herein-after mentioned:

(4.) Every such Place shall, whenever the Ship is registered or re-registered, be inspected by One of the Surveyors appointed by the Board of Trade under Part IV. of the Principal Act, who shall, if satisfied that the same is in all respects such as is required by this Act, give to the Collector of Customs a Certificate to that Effect, and thereupon such Space shall be deducted from the Register Tonnage:

(5.) No such Deduction from Tonnage as aforesaid shall be authorized unless there is permanently cut in a Beam, and cut in or painted on or over the Doorway or Hatchway of every such Place, the Number of Men it is constructed to accommodate, with the words "Certified to accommodate Seamen:"

(6.) Every such Place shall be kept free from Stores or Goods of any Kind, not being the personal Property of the Crew in use during the Voyage:

(7.) Upon any Complaint concerning any such Place as aforesaid, One of the Surveyors appointed by the Board of Trade may inspect such Place, and if he finds that any of the Provisions of this Act with respect to the same are not complied with, he shall report the same to the Collector of Customs at the Port where the Ship is registered, and thereupon the registered Tonnage shall be altered, and the Deduction aforesaid in respect of Space disallowed, unless and until it shall be certified by such Surveyor appointed by the Board of Trade, that the Provisions of the Act in respect of such Place are fully complied with:

(8.) If any such Place in any Ship is not kept free from Goods and Stores as aforesaid, the Master shall be deemed to be in fault, and shall for every such Failure to comply with the Provisions of this Section, forfeit and pay to each Seaman lodged in such Place the Sum of One Shilling a Day for each Day after Complaint made to him by any Two or more of such Seamen during which any Goods or Stores, not being the personal Property of the Crew, are stored or kept therein;

(9.) If in any other respect the Provisions of this Section are not observed with

NOTE.—Crew Spaces for Seamen and Apprentices must now measure 120 Cubic Feet and 15 Superficial Feet for each Person. But if Mess Rooms, Bath Rooms, or Wash Places are provided these may be taken into account, so long as the Sleeping Places have 72 Cubit Feet and 12 Superficial Feet for each Person.

respect to any such Place in any Ship, the Owner shall be deemed to be in fault, and shall for every Failure to comply with the Provisions of this Section incur a Penalty not exceeding Twenty Pounds.

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## SECTION LII.

# ODDS AND ENDS.

For measured mile running—

| | | Miles per hour. | | Knots. |
|---|---|---|---|---|
| 1 mile in 6 minutes | = | 10 | = | 8·68 |
| „ 5·27 „ | „ | 11 | „ | 9·55 |
| „ 5·00 „ | „ | 12 | „ | 10·42 |
| „ 4·37 „ | „ | 13 | „ | 11·29 |
| „ 4·17 „ | „ | 14 | „ | 12·16 |
| „ 4·00 „ | „ | 15 | „ | 13·03 |
| „ 3·45 „ | „ | 16 | „ | 13·89 |
| „ 3·31 „ | „ | 17 | „ | 14·76 |
| „ 3·20 „ | „ | 18 | „ | 15·63 |

A ship's co-efficient of fineness is her under-deck tonnage × 100 ÷ by the product of length × breadth × depth.

Length × breadth × co-efficient of fineness ÷ 420, equals the number of tons a vessel loads to the inch of draught.

The tri-compound engine is supposed to save 22% on the compound in coal consumption. Thus, suppose a steamer 3,000 tons dead weight uses 16¼ tons of coal with compound engines, if tri-compounded her consumption may come down to 12½.

If in addition to this she is fitted for forced draught, a further 4% may be saved, with an increase of speed.

A steamer with compound engines was fitted as a quadruple, with boiler pressure of 200 lbs. Her previous horse-power had been 900 indicated. Her power was increased to 1350 horse. On the trial trip her increase in speed was 1½ knots. Her coal consumption was 1·2 lbs. per horse per hour, or a little over 17 tons a day, with a speed of 12·25 knots.

Fair dimensions for a steamer:—Length, not more than eleven times depth to top of keel. Sixteen depths in length is very extreme. The longer the vessel, the more extra strength she requires, especially longitudinally. Considering a steamer's depth in comparison to her breadth, another point comes forward, namely, stability. Many cargo

* Induced draught has been proved superior to forced draught.

steamers of the three-deck type have in past years been built of such dimensions as length 270 × breadth 34 × depth 24. Such vessels are dangerous if filled with a homogeneous cargo, being very difficult to keep on their legs, the depth being over ·7 of the breadth, which is too much for safety.

Ordinary allowance for coal stowage is 45 cubic feet to the ton as stowed in bunkers. Small coal will stow closer than this if well trimmed, but it is usual to calculate north country coal at 43 cubic feet to the ton; large Welsh coal 45 cubic feet; "Duff," or the fine screenings from coal, 41 feet to the ton.

An imperial gallon of distilled water is the standard of capacity for both wet and dry goods, and with a temperature of 62° Fahrenheit, with the barometer at 30 inches, weighs exactly 10 lbs. *avoirdupois*, and contains 277·2738 cubic inches.

The contents of water casks and tanks on shipboard are all calculated by this standard:—

A ton of water is 35·84 cubic feet, or 224 gallons, but in taking in water 240 gallons is commonly given for a ton.

A tank that measures 4ft. 1in. all ways contains 400 gallons.

A butt contains 110 gallons, a puncheon 72, a hogshead 54, a barrel 36, and a kilderkin 18.

5,280 feet is a statute mile.

6,079 feet is a nautical mile.

1 cubic foot of sea water = 64·11 lbs.

Sea water is 1·026 the weight of fresh water.

Iron $\frac{1}{8}$-in. in diameter is more than equal to hemp rope 1 in. in circumference. For instance, $\frac{1}{4}$-in. chain is stronger than 2-in. rope.

To paint canvas, wet it with salt water, and paint whilst wet or damp.

A cord of dunnage wood is a heap 4 ft. × 4 ft. × 8 ft.

Good blacking for rigging—$\frac{1}{2}$ barrel tar, 6 gls. spirit, 4 lbs. litharge, 4 lbs. lamp black, 2 buckets of boiling brine.

12 to 14 lbs. dry paint requires 6 pints raw oil, 1 pint boiled do., 1 pint turps.

A gallon of mixed paint will cover, on wood, from 50 to 75 superficial yards; on well painted iron, about 80 yards.

Pure red lead, oxide of iron, and white lead mixed with enough black to make it lead-colour, all mixed with boiled oil and driers, but no turps, are the best mixtures for sea use.

Red lead mixed with buttermilk or sour beer is a good mixture for a funnel, to be laid on quite thick.

A cable's length is 100 fathoms or 600 feet, or about $\frac{1}{10}$ of a sea mile.

Red lead with just enough white to lighten it, and mixed with boiled oil, is a good colour for masts and yards.

Oxide of iron (dark red) mixed with boiled oil and the scrapings of varnish pots, is a good mixture for stoke-hole ventilators, and will stand washing off (without soda) a great number of times.

Do not thin out varnish with turps.; good oak varnish at about 7s. to 10s. a gallon is the best for sea use. In cold weather warm it a bit to thin it before using, and do not waste it by using it in anything but fine weather; it must not be put on in frost. In vessels employed exclusively in the coal trade it is found best to give all deck paint work two coats of varnish; it then becomes dirt-proof, and will stand any amount of scrubbing. If well varnished, light coloured work will, in such vessels, stand six months of hard usage.

A mixture of white lead and tallow, such as engineers use, is the best thing to put on any bright iron work, such as screws of after steering gear, &c.

Black lead and oil is a good mixture for winch chains.

In using oil to smooth a heavy sea, experiments have proved that about 2 quarts an hour is sufficient. Any oil is better than petroleum, though this is better than none, and is useful in thinning out any oil which may be too thick.

Canvas beckets, or beckets made of copper strips, made as two belts, one across and the other beneath, are the best for life-buoys, which should be just dropped into them loose, *and should never be toggled.* (A man's fingers are all thumbs in moments of excitement, and if he gets hold of a white line becket all stiff with wet, six men may be drowned whilst he is fiddling with it to get it adrift.)

A vessel going from fresh water into sea water will rise nearly $\frac{1}{4}$ inch to the foot; thus a vessel on a mean draught of 20 feet would rise about $4\frac{1}{2}$ inches.

It is said that Welsh coal will rise to a temperature of 700° F. before actual spontaneous combustion takes place.

To find the weight a tackle will lift. First find the weight one part of the rope will lift; then multiply this by the number of parts at the movable block, and subtract from this one quarter for resistance. Thus, say a rope will lift 3 tons, in a four-fold movable block $4 \times 3 = 12$ tons, and one quarter less for resistance, the tackle should work 9 tons.

Sound travels at the rate of 1,110 feet in a second.

To find how far a vessel is distant from the land by the flash of a gun:—

Note how many seconds elapse between the flash and the report. Then multiply 1,110 by the number of seconds observed and divide into this sum 6,079, which will give the distance in nautical miles from the gun.

Splicing a rope is considered to weaken it one-eighth, yet if it carries away after it is spliced it will seldom give way in the wake of the splice, but will either strand or break above or below the splice.

When rattling down rigging, keep the rattlines 15 inches apart.

All sail gaskets should be periodically examined, especially those on the royal and topgallant yards. Many seamen have lost their lives when stowing a sail with a rotten gasket, and too much care cannot be exercised in keeping all lifts and footropes in good order, for if these by any chance give way, loss of life invariably ensues.

Always keep a good look-out that the footropes of your square sails are well leathered in the wake of the fore and aft stays, for in wet weather a couple of hours will condemn a footrope in a calm if this is not attended to.

When bending a fore and aft sail in the dark, it is an easy matter to tell the head from the tack if you bear in mind that all fore and aft sails are roped on the port side. In bending jibs and staysails always seize the first hank on the head cringle itself, for by doing so, the jib will both hoist and pull down more easily than it will if the first hank is seized to the first eyelet hole.

The longest ropes rove in a sailing ship are the fore royal braces, if they are rove double; if this is not the case, then the fore topgallant braces are the longest ropes in the ship.

Now that wire ropes are so universally used for transporting purposes in both steam and sailing ships, a good rope runner about 5 inches, 25 fathoms in length, is used at each end of the vessel. On this runner should be about four to five feet of round chain, with a strong pair of clip hooks, and by this means a wire hawser can be worked with great ease. Before securing the chain and clip hooks of the runner to the hawser, it should be well parcelled with a piece of old bagging to prevent injury.

Night signalling can be carried on with little trouble by flashes, or the blasts of a steam whistle, and might in some cases of emergency prove most useful. The alphabetical table used in the Royal Navy, and also the "Morse" alphabet, are therefore given here, that they may be at hand if required. Vessels fitted with the electric light can communicate at great distances by this method, and ships have in some

instances been able to do this when completely hull down to each other by flashing on to a dark cloud. In both the following codes all signals are composed of long and short sounds or flashes.

In using steam to extinguish a cargo on fire, unless the steam *quickly* puts out the fire its use may become dangerous. Steam passing over a smouldering, red hot cargo, would produce water gas, which becomes highly explosive when mixed with air, and explodes upon coming in contact with flame.

The heavy rolling of a steamer in ballast is partly due to the weight being in the bottom of the vessel; if it could be raised the vessel would be easier. Easier rolling may be gained by raising the ballast (caution being necessary); by bilge keels; or in a laden vessel by carrying the heavier part of a mixed cargo into the wings of the hold. This last may be dismissed as seldom attainable. Raising the ballast must be done with care, that the vessel's stability is not endangered. The third method—bilge keels—has been proved to work wonders, and to save both time, coal, and strain of hull and engines. A potent cause of excessive rolling is synchronism, as scientists term it, viz., when the period of the roll is in time with the period of the waves: this can often be overcome by altering either course or speed.

The universal system of buoyage is:—

Conical buoys on starboard hand on entering port (or with the main stream of flood tide).

Can buoys on port hand.

Spherical buoys at the ends of middle grounds.

A life-jacket or belt should float in water for 24 hours with 23 lbs. of iron suspended from it.

A life-buoy should float 24 hours with 32 lbs. of iron suspended.

A fair average position for a sailing ship's masts is as follows:—The length being represented by 100 on the load-line, then the foremast will be 20 to 22 from front of stem; mainmast 53 to 55; mizzen mast 80 to 85.

In old-fashioned sailing vessels it was assumed that the length should not exceed four times the beam. Modern clippers, however, frequently have lengths six to seven times the beam.

If a steamer is fitted with deep bilge keels as well as main keel, beware of her in a strong tideway, as she may prove to be very unmanageable under helm.

Fore and aft sails should be set in a steamer whenever they will draw, more especially if there is any sea on, as they steady the vessel, and keep her from jumping about, which loses her way; and, more important still, they greatly ease the engines.

In using oil-bags in heavy weather, it will be found necessary to weight them if hung over the side, to keep them down. If using oil when scudding, it is best to pour it slowly down a W.C. pipe.

The mate should always remember, in steam as well as sail, that he is responsible for the good state of the vessel's rigging, and especially lifts and foot-ropes.

## THE ACTION OF TWIN SCREWS.

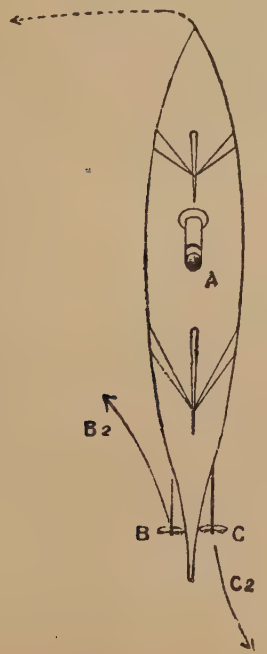
The use of twin-screws in manœuvring is simple, and follows common sense ; but the seaman coming new to them after being used to single right-handed screws must remember that he is now under new conditions. With his single screw he knew that when going 'ahead' the tendency was for his ship's head to move to port, and that coming 'full astern' she would cant to starboard. He must now ignore these conditions; for it does not now matter which of his screws is right-handed and which left; when he starts ahead on the starboard engine and screw, his ship's head will cant to port; the port screw going ahead will cant his ship to starboard.

There are, however, a few matters which may be referred to in more detail, and which have been settled by careful experiments in smooth water.

With one propeller 'ahead' and the other 'astern,' a ship can be turned nearly on her own centre without headway.

With both screws going ahead a ship will steer as well as a single screw vessel.

Turning. Helm amidships. With one screw 'ahead' and the other 'astern,' the ship should turn nearly on her own centre.

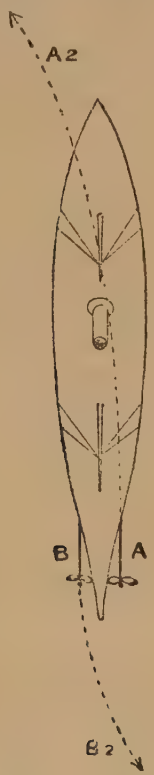



HELM AMIDSHIPS.

The vessel *A* is going astern on her port screw *B*, and ahead on her starboard screw *C*: These two forces send ship's head off in direction of dotted arrow. The wash or race of the "astern" screw *B* is delivered forward as *B* 2, which increases the water pressure on the port run, or deadwood, and assists in canting ship's head to port. The race from the 'ahead' screw *C* is directed aft as *C* 2, and diminishes the pressure on that side, and thus helps in the same direction as the other forces.

But the time taken in turning is longer than if she was turned (in a larger circle) with both screws going ahead, and using the rudder.

The ship's head turns towards the side on which the screw is going 'astern;' two powers help towards this; the first is the action of the screws as shown above; the second can be best explained by a second diagram.




HELM AMIDSHIPS.

Screw *A* going "ahead" delivers its thrust along the dotted arrow *A* 2.

Screw *B* going "astern" delivers its thrust in the direction of *B* 2.

Both forces thus uniting to caut ship's head to port.

The 'ahead' screw has greater thrust than the 'astern' screw, and this excess tends to propel the vessel ahead and thus increase the turning circle. This is greater in vessels of fine form; in bluff vessels it is not so noticeable.

Turning. Using the helm. One screw 'ahead' and one 'astern': the time taken in turning is greater than if *both* screws were 'ahead,' with use of helm, but ship turns nearly on her centre. The helm only assists in a small degree, but it *does* assist, for if the helm is put against the turning direction it will be found that the vessel will scarcely move at all.*

* In a small twin-screw yacht the helm would be of greater assistance than in a vessel of large tonnage and fuller form.

With one engine (or screw) damaged, a ship can be kept on her course by the rudder, though, naturally, different ships require different degrees of helm. In early naval experiments some vessels were found to require *double* the helm of others; in some cases as much as 16 degrees.

The relative efficiency of in-working and out-working twin-screws need not be theorized upon here. Engineers differ greatly in their opinions on the subject, and the chief matter of interest to the seaman lies in the practical use of twin-screws. Neither need one touch on such cases as one propeller lying forward of the other, both being of different pitch, except that in such a case the coarser pitched screw would probably have more power when coming 'astern.'

Special steam trials have been made for the purpose of this article, and in smooth water and no wind a twin-screw vessel may be expected to act as has been stated.

As to the comparative merits of in-working and out-working twin-screws, Mr. R. E. Froud, from experiments with models has published the following conclusions (in a paper read before the Institution of Naval Architects, 31st March, 1898).

With in-working twin-screws the arrangement is favourable to speed efficiency rather than otherwise, but there is not any great difference between the two systems.

In-working screw-ships involve no difficulty in steering, they are as workable as out-turning screw-vessels.

Opposing results to the above might obtain with fuller vessels, and in such, in turning, screws might very possibly be found less efficient. Mr. Froud's models were of fine lines.

# APPENDIX.

## MERCHANT SHIPPING ACT, 1906.

As the new Merchant Shipping Act makes certain changes in rules governing shipping procedure mentioned here and there in this book, an appendix stating these changes which effect shipping both British and Foreign is given.

Except where otherwise stated the Act comes into force on 1st July, 1907.

Ordinary Legal Procedure affecting the Shipping and Discharge of Seamen, &c., &c., has not been touched upon as it does not come under the head of "SEAMANSHIP," but the following summary of changes deserve attention.

### FOREIGN SHIPS.

Foreign ships whilst they are within any port in the United Kingdom are brought under the British Load Line, Grain Cargo, and the Life Saving Appliances Regulations ; and power is given to the Board of Trade to detain in any port in the United Kingdom any foreign ship which is unsafe by reason of defective condition of hull, equipments or machinery.

These provisions come into force 1st January, 1909, or such other day not being more than twelve months later, as the Board of Trade may appoint ; and they do not apply to a foreign vessel coming into a port in the United Kingdom for any purpose other than that of embarking or landing passengers, or taking in or discharging cargo or taking in bunker coal.

### COASTING STEAMSHIPS.

Coasting steamships of under 80 tons register are, as from the 1st June, 1907, brought under the Load Line Regulations, but the Board of Trade has power to exempt from this provision any class of steamships so long as they do not carry cargo.

### ENTRY IN LOG BOOK OF BOAT DRILL, &C.

The master of any British ship shall, as from the 1st June, 1907, enter in the official log book, a statement, or if there is no official log book, cause a record to be kept of every occasion on which boat drill is practised on board the ship, and on which the life-saving appliances have been examined.

### ALTERATION OF LOAD LINE ABROAD.

The Board of Trade has been empowered to issue Regulations under which the Load Line on a British ship may be altered abroad, upon either an alteration being made in the Freeboard Tables, or in the vessel.

### TIMBER ON DECK.

The law as to the carriage of timber on deck, between the last day of October and the 16th day of April, has been amended and codified.

### HEAVY WOOD GOODS.

The Board of Trade is empowered to issue Regulations authorising the carriage of heavy wood goods in covered spaces on deck on such class of ships as may be approved by the Board.

### LIGHT WOOD GOODS.

Light wood goods (that is deals, battens, or other light wood goods each unit of which is of a cubic capacity of not greater than 15 cubic feet) may be carried :—

(i) In the case of an uncovered space on a deck forming the top of a break, poop, or other permanent closed in space on the upper deck, to the height of three feet above the top of that closed in space.

(ii) In the case of an uncovered space (not being a space forming the top of any permanent closed in space on the upper deck, or a space forming the top of a covered space) to the height of the mainrail, bulwark, or plating, or one-fourth of the inside breadth of the ship, or seven feet, *whichever height is the least.*

(iii) In the case of a covered space to the full height of that space.

The Board of Trade may make Regulations for the protection of seamen from any risk arising from the carriage of the goods in any uncovered space. (*See* Rules, page 433.

These provisions as to timber cargoes came into operation on the 21st December, 1906, and do not apply to any ship not bound to a port in the United Kingdom which comes into any port in the United Kingdom under stress of weather, or for repairs, or for any other purpose than the delivering of her cargo.

### Foreign Seamen.

After the 31st December, 1907, a seaman is not to be engaged, on board any British ship at any port in the British Islands or on the continent of Europe, between the River Elbe and Brest inclusive, unless he satisfies the Superintendent or other officer before whom he is engaged, that he possesses a sufficient knowledge of the English language to understand the necessary orders which may be given to him in the course of the performance of his duties. The section does not apply to any British subject or inhabitant of a British Protectorate or to any Lascar.

A foreign seaman holding a discharge showing that he has once satisfied the language test is not, in the absence of special reasons, to be liable to re-examination.

### Increase of Crew Space.

The space required for each seaman or apprentice in a British ship is increased to 120 cubic feet, with a surface area of not less than 15 superficial feet measured on the deck or floor.

In estimating the space available there may be taken into account the space occupied by any mess rooms, bath rooms, or washing places, appropriated exclusively to the use of the seamen and apprentices, so, however, that the space in which the seaman or apprentice sleeps, shall not in any case be less than 72 cubic feet, with a floor space of 12 superficial feet.

The increased spaces are not to apply :—

(1) To a ship registered before the passing of the Act.

(2) To a ship in course of construction on the 1st January, 1907.

(3) To a ship of not more than 300 tons burden.

(4) To any fishing boat.

(5) To the places occupied solely by Lascars and appropriated to their use.

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[Though the Act does not say that drills are to be held, the meaning is that they shall be ; and should loss of life occur, and it is proved that no drill had been held for that voyage, it would go hard with master and owner if the case came into court.]

From December, 1906—The new carriage of timber clauses came into force.

*Heavy* timber may now be carried to the full height in shelter decks, or any covered space ; but, still, may not be carried on an open deck, and only in approved ships.

Light wood goods may be carried on any deck erection, such as a bridge, to a height of three feet. They can be carried in a covered space *not* included in tonnage, but not *on* that space. On the main deck they may be carried to the height of the mainrail, or bulwark, or one quarter the ship's inside breadth, or seven feet, *whichever height is the least.* But in these cases provision must be made for the safety of the crew to the satisfaction of the Board of Trade.

If the rules for the carriage of grain are not complied with the *person liable for such offence* can now be prosecuted *summarily* and fined up to £100. This clause requires *very careful attention* on the part of shipmasters, for it is they who will be prosecuted.

Crew space is now 120 cubic feet per man, but mess rooms, bath rooms, and wash houses will be taken into this total. Note, however, that the place in which men sleep must have 72 cubic feet per man. This clause is not retrospective.

The clause governing officers' certificates has been altered. Now, foreign traders, home trade passenger ships sailing from the United Kingdom, and foreign steamers carrying passengers between places in the United Kingdom, must carry

A certificated master.

If the ship is 100 tons, one officer besides, holding a certificate of (not lower than)

Mate in a home trade passenger ship,

Second mate in a foreign going sailing ship of not more than 200 tons burden,

Only mate in other foreign going ships.

If a foreign going ship carries more than one mate, the first and second mates must be certified.

The change is that a foreign going ship may clear with a master and a "Second" mate ticket man as mate.

Coasting traders may therefore still go to sea without a certified man on board.

Alien masters and mates cannot now be granted pilotage certificates, but those in possession of them can have them renewed.

Nothing has been done to keep out aliens from commanding or officering British ships, and our vessels can still sail without a single British subject on board as some do.

A seaman may now be rated at A.B. after three years sea service. If an A.B. is disrated it must be entered in the official log and a copy of the entry must be given to the man. But note that there is no compulsion to carry any able seamen at all, as in the Board of Trade instructions upon undermanning only "deckhands" are mentioned. And, indeed, it is very well known that a smart young fellow can do all the ordinary duties of an able seaman, in steam, after a very short probation. A year is ample to learn these duties. If there were a deck crew of five good O.S. and one mate, this would be sufficient, if the master kept his own watch.

Foreigners must now understand enough English to obey orders. *Our own subjects* are exempt from this requirement, whether they be Lascars or *any other nationality*.

There is a compulsory scale of provisions for the first time, and from July 1st, 1908, any foreign going or home trade ship over 1000 gross tons, must carry a certified cook.

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## RULES ISSUED BY THE BOARD OF TRADE (7th FEBRUARY, 1907) FOR THE CARRIAGE OF TIMBER.

### Rule I.

### Classes of Ships approved for the Purpose of carrying Heavy Wood Goods as Deck Cargo.

The classes of ships which are approved for the purpose of carrying heavy wood goods as deck cargo are iron or steel steamships having covered spaces, that is to say, poops, bridges, forecastles or shelter decks, which form part of the permanent structure of the ship, and which comply with the following conditions:—

(*a*) The space must be within an erection which extends from side to side of the ship.

(*b*) The outside plating must be continuous from deck to deck and throughout the full length of the space.

(*c*) The length must be bounded by iron or steel partitions, and the total area of the openings in any such partition must not exceed one-fourth of the area of the partition itself.

### Rule II.

### Regulations with respect to the Loading of Heavy Wood Goods as Deck Cargo.

1. Heavy wood goods may only be loaded *in* covered spaces which form part of the permanent structure of the ship, and which comply with the conditions specified in the preceding Rule I.

2. Heavy wood goods must not be loaded in any covered space in such a manner as to make the ship unfit, by reason of instability, to proceed to sea and to perform the voyage safely, having regard to the nature of the service for which she is intended.

3. Heavy wood goods must be properly stowed and secured so as to prevent shifting.

### Rule III.

### Regulations for the Protection of Seamen from risk arising from the Carriage of Wood Goods as Deck Cargo in Uncovered Spaces on board Ship.

1. When wood goods are carried in an uncovered space, there shall be fitted on each side of the ship temporary rails or bulwarks of a substantial character for the full length within which the deck cargo is stowed, extending to a height of *not less* than 3 feet above the line of the top of the deck cargo.

2 The uprights of such temporary rail or bulwark shall be of substantial scantling and be placed not more than 4 feet apart; the heels of the uprights shall extend down to, and rest on, the deck of the vessel.

3. There shall be attached longitudinally to these uprights for the full length of the deck cargo, spars, deals, battens, guard-ropes or chains, at intervals of not more than 12 inches apart in a vertical direction. If ropes or chains are used, they shall be set-up taut and securely attached to each upright.

4. The temporary rails or bulwarks may consist of closely spaced vertical deals, provided they are properly secured and that there are protected openings at intervals for water clearance.

5. Where light wood is carried in an uncovered space (not being a space forming the top of any permanent closed-in space on the upper deck or a space forming the top of a covered space) and the uncovered space is bounded by an open rail formed of wood, iron, or steel stanchions and longitudinal rods, battens or chains, no measures for the protection of the seamen shall be deemed sufficient if the height of such rail exceeds 3 feet 6 inches.

### THE ABOVE CHANGES MEAN AS FOLLOWS:—

From 1st January, 1909.—Foreign vessels when in our ports will require to be marked with a Load Line.

From the same date they will also be liable for detention if found defective in hull, equipments or machinery.

From 1st October, 1907.—The carriage of grain clauses will apply to foreigners.

From 1st January, 1909.—Foreign vessels will be liable to survey for boats and life-saving gear as British vessels.

From 1st June, 1907.—coasting steamers under 80 tons reg. must be marked with Load Lines.

From 1st June, 1907.—British shipmasters must enter in their log-books a note of every occasion on which a boat drill was held, and life-saving appliances examined.

## MARITIME CONVENTIONS ACT, 1911.

(EXTRACT FROM.)

The master or person in charge of a vesel shall, so far as he can do so without serious danger to his own vessel, her crew and passengers (if any), render assistance to every person, even if such person be a subject of a foreign State at war with His Majesty, who is found at sea in danger of being lost, and, if he fails to do so, he shall be guilty of a misdemeanour.

## MERCHANT SHIPPING (CONVENTION) ACT. 1914.

(EXTRACT FROM).

Part 1. Sect. 5. (1). The master of a British ship registered in the United Kingdom shall, when a wireless distress call as described in PART I. of the Second Schedule to this act is received on his ship from any other ship, proceed with all speed to the assistance of the persons in distress, unless he is informed by or on behalf of the ship from which the call is received that his assistance is not wanted, or unless for any other reason it is impracticable, unreasonable, or unnecessary in the special circumstances of the case to so proceed, and, if he fails to comply with this provision, he shall be guilty of a misdemeanour.

(2) In any case where the master of a British ship registered in the United Kingdom on receiving the wireless distress call from a ship does not proceed to the assistance of the persons in distress, he shall enter the fact and the reasons justifying his actions in the official log book, and if necessary, immediately inform the master of the ship from which the call is received.

Sect 6. (1) The master of a British ship registered in the United Kingdom shall not use or display or cause or permit any person under his authority to use or display, nor shall any person on a British ship registered in the United Kingdom use or display—

(*a*) any signal or call which is recognised as a signal or call of distress or danger under section four hundred and thirty four of the principal Act or otherwise, except in circumstances which justify the use of the signal or call ; or

(*b*) any private signals, whether registered or not, which cannot easily be distinguished from any such signals or calls.

(Disobeying this section may lead to a fine of not exceeding £50.)

Sect 7. (1) A passenger steamer which is subject to the provisions of Part II. of this Act shall be provided with a Morse signalling lamp of a sufficient range.

(2) A printed copy of the code of urgent and important signals specified in Part II. of the Second Schedule to this act shall be placed in a conspicuous place in the chart room of every ship registered in the United Kingdom.

Part II. Sect. 8. (1) Every passenger steamer which is registered in the United Kingdom shall be manned with a crew sufficient and efficient from the point of view of safety of life at sea for the purpose of her intended voyage, and shall during her voyage be kept so manned.

(Not complying with the provisions of this section may lead the owner into a fine of not exceeding £100, and the master of the ship into a fine of not exceeding £50.)

Part III. Sect 15. (1) Subject to the provisions of this Act, every British ship registered in the United Kingdom which carries 50 or more persons shall be provided with a wireless telegraphy installation, and shall maintain a wireless telegraphy service which shall be at least sufficient to comply with the rules made for the purpose under this Act, and shall be provided with certified operators and watchers at least in accordance with those rules.

(Not complying with the provisions of this section may lead the shipowner or master into a fine of not exceeding £500.)

Sect. 16. (2) The Board of Trade may by rules made under this section exempt from the obligations of this Act as to wireless telegraphy—

(2) Ships while on voyages the course of which does not take the ship more than one hundred and fifty sea miles from the nearest coast, if the Board are satisfied that the route and the conditions of the voyage are such as to render compliance with those obligations unreasonable or unnecessary ; and

(b) Sailing ships on which, owing to the peculiar or primitive nature of their build, it is impossible to provide a proper wireless telegraphy installation.

Part IV. 18. (1) Where any provisions of Parts II. and III. of this Act are applicable to a British ship registered in the United Kingdom, that ship shall not proceed to sea from a port in the United Kingdom unless a certificate (in this Act referred to as a safety certificate) has been granted in respect of the ship, and is for the time being in force, and shall be provided with a safety certificate when coming into such a port.

(2) If the provisions of this section are not complied with in the case of any ship, the master of the ship shall be liable to a fine of not exceeding £100.

(4) The safety certificate shall certify, in the form set out in the Fourth Schedule to this Act, that the provisions of the Convention therin referred to have been complied with, and shall be a certificate granted by or under the authority of the Board of Trade under this Part of this Act.

Sect. 19. (3) A safety certificate shall not be in force for more than one year from the date of its issue, nor after notice is given by the Board of Trade to the owner, agent, or master of the ship in respect of which it is granted, that the Board of Trade have cancelled the certificate.

Part VI. (5) This Act shall come into operation on the first day of July nineteen hundred and fifteen.

## FIRST SCHEDULE. (EXTRACT FROM)

### CHAPTER III. ART. 14.

Articles 2, 10, 14, 15, 31, of the International Regulations for the Preventing of Collisions at Sea shall be amended in accordance with the following provisions:—

Art 2. The second white mast-head light to be compulsory.

„ 10. A permanent fixed stern light to be compulsory.

„ 14. A special day signal to be compulsory for motor vessels.

„ 15. A special sound signal to be established for use by a vessel in tow, or if the tow is composed of several vessels by the last vessel of the tow.

„ 31. Article 31 to be modified in the following manner:— Add to the lists of both day and night signals the international radio telegraph distress signal.

## SECOND SCHEDULE.

### PART I.

#### WIRELESS DISTRESS CALL.

The following signal repeated at short intervals.

— — — ——— ——— ——— — — —

#### WIRELESS DANGER CALL.

The following signal repeated at short intervals ten times at full power.

——— ——— ——— (T T T).

the call to be followed after an interval of one minute by the message repeated three times at intervals of ten minutes.

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